FEASIBILITY STUDY FOR A MAJOR MARINE CENTER AT AVERY POINT, CT

JUN 1983

Connecticut - Coastal Zone Management Program

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DRAFT

FINAL REVIEW DRAFT

FEASIBILITY STUDY FOR A MAJOR MARINE CENTER AT AVERY POINT, CONNECTICUT

Submitted To

MR. RICHARD GARDNER
SENIOR POLICY ANALYST
OFFICE OF POLICY AND PLANNING
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
WASHINGTON, D.C.

By

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July 20, 1983

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Mr. Richard Gardner
Senior Policy Analyst
Office of Policy and Planning
National Oceanic and Atmospheric Administration
Room 5222
14 and Constitution Avenue, N.W.
Washington, D.C. 20230

Dear Mr. Gardner:

We are pleased to submit the final review draft of our Feasibility Study for a Major Marine Center at Avery Point, Connecticut.

As you are aware, the methodology for preparation of this study, as prescribed by our contract with NOAA, relied heavily on face-to-face and telephone interviews. The early deadline for report completion precluded extensive cross-checking and validation of information obtained through these interviews. This proved a particularly vexing problem with respect to information on university budgets and spending. Although published sources were used wherever available, we had to rely on extensive telephone interviews to obtain much of this essential information.

This final review draft, in addition to going to you, will be distributed to administrators and faculty at the University of Connecticut, both at Storrs and at the Avery Point Campus, for their review and comments. We would very much appreciate having all comments on the report within the next two weeks, so that a final report can be submitted to you within the next month.

Sincerely yours,

Ralph M. Field

RMF:mj

CONTENTS

ACKNOWLEDGEMENTS

In undertaking this study, Ralph M. Field Associates obtained information and assistance from numerous persons in government agencies, educational institutions, research organizations, and businesses. We thank them for their generous assistance and cooperation. Special appreciation and thanks are owed to the following officials of the University of Connecticut:

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Dr. Julias Elias, Dean, College of Liberal Arts and Sciences

Dr. Lewis Katz, Acting Vice President for Graduate Education and Research

Dr. James Baird, Director, Avery Point Campus

Dr. Victor Scottron, Director, Connecticut Sea Grant Office

Dr. Sung Feng, Director, Marine Sciences Institute and Acting Head, Marine Sciences Department

Dr. Lance Stewart, Program Leader, Marine Advisory Service

Assistance was also provided by Dr. Howard Weiss, Director of Project Oceanology and Mr. Samuel Powel, Technical Director, U.S. Coast Guard Research and Development Center.

PREFACE

The U.S. Senate Appropriations Committee in May, 1982, directed the National Oceanic and Atmospheric Administration (NOAA) to study the feasibility of establishing a major marine center at Avery Point, Connecticut. The Committee called upon NOAA

> "to study and make recommendations for developing Avery Point into a major marine center"

and to

> "address the feasibility and planning for the development of a marine center at Avery Point, Connecticut, which will include Federal, State, academic, industry and private involvement."

Senator Lowell Weicker, Jr., Republican of Connecticut, chairman of the Subcommittee on State, Justice, Commerce, and the Judiciary Appropriations, which has responsibility for ocean affairs, said he considered

> "... the facilities at Avery Point in Groton, owned and operated by the University of Connecticut, to have the potential and capacity to support a major marine research center."

Senator Weicker told the Appropriations Committee that he

> "was concerned about the lack of facilities in the Northeast, presently in use, for research and development."

The Senator's concern focused on studies of inshore fish stocks, marine aquaculture research, hydrography of the Continental Shelf, and marine technology in support of East Coast research.

To conduct the feasibility study, NOAA contracted with Ralph M. Field Associates. NOAA directed that the study be conducted in three phases. The first is an analysis of marine related activities currently taking place at Avery Point. The second is an identification of "the perceived pressing needs of the marine and coastal constituencies of the various functions, programs and activities now at Avery Point." The third is a discussion of the "expansion or addition of existing functions that would need to be provided by a major center serving the principal needs of those who are currently served by Avery Point activities."

INTRODUCTION

Avery Point is a promontory of land on Long Island Sound near the mouth of the Thames River. Comprising 42 acres, Avery Point is located in the City of Groton, near the site of the U.S. Navy's major East Coast submarine base as well as the Electric Boat Division of General Dynamics, builder of nuclear powered submarines. Avery Point is located across the river from the city of New London, site of the U.S. Coast Guard Academy and the Naval Underwater Systems Center (NUSC).

The New London-Norwich area provides non-agricultural employment for more than 95,000[1] people, much of it marine-related industry. Electric Boat alone has some 22,000 employees. Other local industries that are directly marine-related include Eclechtech Associates, Science Applications, Inc., Analysis and Technology, Inc., Mystech Associates, Inc., and UNC Naval Products Company. Major non-marine industries include Pfizer Inc., Phelps Dodge Copper Products Co., and Monsanto Chemical Co.

U.S. Coast Guard at Avery Point

During and immediately following World War II, Avery Point was occupied by the U.S. Coast Guard which built a number of buildings for use as a training center. Declared surplus by the Coast Guard in the late 1960's, the site was eventually transferred to the University of Connecticut (UCONN). The site is now the University's southeastern Connecticut campus.

The Coast Guard remains a major user of the Avery Point site, however. In 1972, some six years after the site was transferred to UCONN, the Coast Guard returned to establish a Research and Development Center in some 70,000 square feet of floor space leased from the University. The R&D Center has a staff of 112, which is expected to increase to 152 by the end of the year. The Center's FY 83 budget is approximately $5 million.

There has been considerable speculation during the past few years that the R&D Center at Avery Point might be closed, at first because of competition from

[1] Total non-agricultural wage and salary employment in the New London-Norwich Labor Market Area, by place of work, March 1983. Source: Connecticut Labor Department.

other states (there was discussion, for example, of moving the center to Delaware or Massachusetts), and more recently as the result of Coast Guard budget cuts. The possible relocation of the Center has attracted considerable attention from Connecticut's elected officials. In 1981, the state's General Assembly authorized a $10 million bond issue to finance construction of new, permanent quarters for the Center. Because of budget constraints, the Coast Guard has not yet accepted this proposal and has postponed a final decision on its long-term future location. For the short term, however, the Center appears likely to remain at Avery Point. The Center is currently negotiating a renewal of its lease with the University at Avery Point. A one-year, lease renewable over a five-year period, is expected to be signed.

The University of Connecticut at Avery Point

As the University's southeastern campus, Avery Point is a regional educational center serving some 650 students. Most of these students are enrolled in the University's comprehensive freshman-sophomore program. Approximately one-third of the students at the campus are adults from the region seeking continuing education.

Four UCONN units at Avery Point relate directly to marine affairs: the Marine Sciences Institute, the Marine Sciences Department, the Sea Grant Program, and the Marine Advisory Service.

Marine Sciences Institute. The Marine Sciences Institute (MSI), established in 1968, is the core of UCONN's marine science research program at Avery Point. The Institute currently has a staff of 11 researchers, who also act as resident faculty of the Marine Sciences Department, plus a 13-member support staff.

Marine Sciences Department. The Marine Sciences Department (MSD), established in 1979 when the MSI was reorganized, offers studies leading to degrees of Master of Science and Doctor of Philosophy in Oceanography. A Master of Science in Ocean Engineering is offered jointly through the School of Engineering. The Department has 11 faculty members, although the equivalent of only 6.5 are assigned to teaching marine sciences at Avery Point; the other 4.5 teach non-marine courses to undergraduates at Avery Point or in

other departments at Storrs, namely the Geology and Geophysics Department and the Biological Sciences Group, which have larger student enrollments. At present, 19 M.S. students and 10 Ph.D. students are enrolled in the Department of Marine Sciences.

Sea Grant Program. UCONN's Sea Grant Office administers Sea Grant funds received from the Federal government and serves as a statewide clearinghouse for information on marine affairs. Although the Office was established in 1980, Federal Sea Grant Coherent Project funds were not received until 1982. Sea Grant staff consists of a director and an assistant.

Marine Advisory Service. The Marine Advisory Service (MAS) was established in 1974 at Avery Point as a unit within UCONN's Cooperative Extension Service. Its main function is to facilitate the transfer of information and technology to users such as marina operators, commercial fishermen, and coastal municipal governments. MAS staff consists of three professional extension agents and four part-time assistants.

In addition to the Coast Guard R&D Center and the various UCONN programs, two other institutions conduct activities in leased space at Avery Point: Project Oceanology and the Hartford Graduate Center.

Project Oceanology. Project Oceanology is a multi-purpose marine education center established in 1974 by a group of educators and community leaders. Serving a consortium of secondary school systems and colleges in southeastern Connecticut, the project provides study cruises, field trips, and laboratory and classroom programs. The staff includes a director, boat captain, two full-time instructors, and several part-time instructors during the summer months.

Hartford Graduate Center. The Hartford Graduate Center, founded in 1955 as an extension of Rennsselaer Polytechnic Institute, has operated a branch campus at Avery Point since 1977. The campus currently enrolls 250 students seeking Masters degrees in business administration, management, and computer science. Courses are offered in the evening by a 25-member faculty.

THE GOAL: A "MAJOR MARINE CENTER"

The Avery Point complex just described already contains elements of a "major marine center":

- o The Coast Guard R&D Center, with an annual budget of approximately $5 million, is a major research center -- the central research and development facility supporting the regulatory and operational programs of the Coast Guard.

- o The marine science programs of UCONN, though small when compared to the Coast Guard Center or to many other universities, provide beneficial marine research, education, and extension services.

- o Both UCONN and the Hartford Graduate Center provide additional educational services which, though not directly marine related, serve industry and residents of an area whose economy is overwhelmingly dominated by marine-related institutions and industries.

The goal of developing Avery Point into a major marine center seems most likely to be achieved by building on this mix of elements already present. The legislation authorizing this study contemplates a mix of participants when it refers to a center that would "include Federal, State, academic, industry and private involvement." At the very least, this implies that no one institution or government represented in the present complex -- which already includes Federal, State, academic, and private involvement -- should be expanded to squeeze out the others. NOAA, in its Request for Proposals, carried the focus on the existing complex a step further when it directed that this study address:

> "the gap between the perceived needs of the northeastern states marine community and the existing capabilities of the Avery Point complex."
>
> "This gap would then represent the expansion or addition of existing functions that would need to be provided by a major center serving the principal needs of those who are currently served by Avery Point activities. However, it may not necessarily indicate those functions of a major marine center that are beyond the purview of what already occurs at Avery Point." [Emphasis added]

But which elements of the present Avery Point complex deserve principal attention in this study? Not the Coast Guard R&D Center, we concluded, since the Center serves national needs; the needs of the "northeastern states marine community" are incidental. Nor have we focused on expanding educational services that are only indirectly related to the marine sciences.

The report thus focuses on the marine-related activities of the University of Connecticut at Avery Point. The kinds of services now provided by elements of the University -- research, education, extension -- directly benefit the northeastern states marine community, and it seems useful to explore whether expansion of those services in particular directions can provide greater benefits to that community. Moreover, it is difficult to envisage a "major marine center" at Avery Point that would not include substantially expanded services of the kinds already provided by UCONN at the Avery Point complex. Accordingly, this report addresses principally the opportunities for expanding the present complex at Avery Point into a major, university-linked, marine sciences[1] center.

Essential Components of a University-linked Marine Sciences Center

Five elements are essential to carry out the mission of any university-linked marine sciences center: personnel, facilities, funding, leadership, and an institutional mission or goal.

Personnel. The mainstay of any university-linked marine sciences center is its people: its professors, graduate students, and administrative leaders. At the heart of a successful center are a number of outstanding, aggressive researchers. These scientists provide academic instruction, define research goals, lead research efforts, and attract graduate students and research contracts. It is essential that this staff collectively have a multidisciplinary breadth of expertise. Oceanography has evolved into a sophisticated, interdisciplinary science often focusing on the analysis of ocean processes and not merely descriptions. Even if an institution chooses to concentrate on one or a few disciplinary areas, almost every research effort is pursued by an interdisciplinary approach. Accordingly, the staff should reflect the biological, chemical, physical, geological, and geophysical aspects of oceanography.

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[1] The term "marine sciences," as used in this report, refers to scientific study of the ocean and its immediate environs. "Oceanography" is used as a synonym for "marine sciences." "Marine affairs" is a much broader term which can include, for example, marine law and marine policy.

The interaction of graduate students and faculty is close and necessary. The learning experience of the graduate students is enhanced intellectually as well as financially, through participation in research projects. The research projects, in turn, benefit from the curiosity and eagerness of the graduate students.

Facilities. To support the center's people, physical facilities must be provided. Typically, these facilities consist of scientific laboratories, instrumentation, equipment, computers, research vessels, a library, dormitory, and classroom and office spaces.

Funding. To support its personnel and facilities, the center needs operating funds, generally of two kinds: so-called "hard" funds supplied by the sponsoring institution and "soft" funds in the form of external grants and contracts. In addition, if an entirely new center is being established or if an existing center is being greatly expanded, there is need for "start-up" funding.

Leadership. The critical mass of people, facilities, and funding cannot be assembled without forceful leadership. The center needs a strong administration -- one that will be effective in recruiting and maintaining the research staff and graduate student enrollment as well as institutional base funding and external grants and contracts.

Leadership depends not only on having the right people as leaders, but also on administrative organization and institutional support. The administrator needs authority to implement his or her decisions and must be able to count on sustained financial and administrative support from high-level university officials.

Institutional Mission. Finally, if a center is to persuade scientists and funding sources of its usefulness, it should have a well-defined institutional goal and plan. Commonly, academically-linked marine science centers have a three-fold set of objectives which include research, education, and outreach services. Basic rather than applied research is typically preferred at existing centers of excellence; applied research, even if excellent in quality, is often avoided by the academic community because it is believed to provide less "intellectual creativity."

The largest centers cover all aspects of oceanography, including expensive "blue water" research as well as coastal investigations. Smaller centers may choose (or be forced by funding realities) to focus their efforts, perhaps on a particular discipline or geographically defined area. The chosen focus largely defines the institution's mission.

At What Level Does a Marine Sciences Center Become "Major"?

At what point does the mix of professors, graduate students, facilities, and funding reach the critical mass that entitles a university-linked, marine sciences center to be considered "major"? Should a major center be one that is prominent in its state, in its region, in the nation? Should prominence be measured by the quality of the institution's work, by the number of faculty members or graduate students, by the number of advanced degrees granted, by the size of the program budget? No precise standard is possible, but some standard is necessary in order to explore the feasibility of establishing a "major" center at Avery Point. To aid in fashioning this standard, characteristics of a number of marine sciences centers are examined in Appendix 2.

For the purposes of this report, we have concluded that the most useful single indicator of a "major" center is its funding level. Even though the amount of needed funding can only be approximated, we are confident that a "major" center requires an annual budget at least as large as SUNY's center at Stony Brook (roughly $3 million) and perhaps closer to that of the center at the University of Rhode Island (approximately $14 million). For purposes of discussion, we have assumed that a "major", university-linked, marine sciences center requires an operating budget of $6 million.

TOWARD A STRATEGY FOR A MAJOR MARINE SCIENCES CENTER AT AVERY POINT

Of the five essential elements already described, three are critical to any strategy for developing Avery Point into a major, university-linked marine sciences center: funding, leadership, and institutional mission. Once all three are in place, the remaining two elements -- personnel and supporting facilities -- can be expected to follow. If funding, leadership, or institutional mission is lacking, however, no strategy for developing Avery Point into a major center is likely to be successful.

Funding

Start-up funding. As already noted, expansion of Avery Point into a major new center will require substantial "start-up" funding. This funding is essential to attract professors and graduate students and to provide them with supporting facilities and some initial security during the first years of the new center's operations. The best scientists are unlikely to be willing to compete for today's elusive research dollar without being assured that committed institutional support provides them reasonable opportunity to become established. Since many scientific projects require a minimum of two to three years to complete and another one to two years to get the results into the peer community for evaluation, the commitment of start-up funding should be sufficient to sustain the new institution and its staff for about five years.

The amount of needed start-up funding cannot be determined exactly. Nevertheless, given the need to support the expanded center for about five years until major outside grants and contracts can be obtained, plus the need to expand physical facilities, we estimate a need for start-up funding of $5 to $7 million. (See Appendix 2, pages A2-11, 12.)

To develop Avery Point into a major center at this time, the development strategy must count on much of the start-up funding coming through UCONN. It is true that there are several other possible sources, some of which might in time make important contributions, but none would realistically preempt the need for substantial contributions from UCONN:

- o An unexpected bequest? Always a remote possibility, though only a hope rather than the basis for a strategy.

- o A major Federal grant for expansion? During our research, some officials in Connecticut expressed optimism about prospects for obtaining a major grant. We found no Federal agency currently authorized or budgeted to provide such funding, however. Also, start-up funding for a major new institution does not seem likely to receive high priority during these times when established institutions are reporting difficulty obtaining Federal grants to support their existing operations.

- o Donations from foundations, corporations, private citizens? Sums of the magnitude needed for major expansion are likely to come, if at all, only after several years of careful cultivation by the University. Moreover, knowledgeable donors are unlikely to give large sums unless UCONN itself provides sustained funding to demonstrate its commitment to an expanded center.

- o Another university or institution, which might join with UCONN in a partnership or consortium to sponsor an expanded center? Also a possibility.[1] UCONN might, for example, seek to follow the precedent of the University of Miami, where the Rosenstiel School of Marine and Atmospheric Science and NOAA have jointly established a Cooperative Institute for Marine and Atmospheric Studies (CIMAS). No other important institution is likely to join with UCONN, however, unless UCONN itself provides substantial funding not only to defray a share of start-up expenses but also as an earnest of its intention to provide continuing support at a level significantly higher than in the past.

To repeat, then, a strategy to develop Avery Point into a major marine sciences center must, at this time, count on much, if not all, of the start-up funding coming through UCONN.

As a practical matter, we see little likelihood that UCONN will, by itself, provide this funding. The University finds itself in straitened economic circumstances; funding available for new and expanded programs is very scarce indeed. To allocate substantial start-up funding for major expansion at Avery Point, the University would need to assign that expansion a prominent place in the broad spectrum of University priorities. Available evidence

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[1] This possibility is explored further in the Postscript at the end of this report.

suggests, however, that marine sciences are not high on UCONN's priority list:

- o UCONN's draft planning document, Opportunities for the '80's, which is intended to "chart a future course for the University, regardless of the financial resources available," does not designate marine sciences as one of the University's twelve "Programs of Excellence." The designated programs, selected on the basis of "...quality, programmatic balance, need, demand, and effectiveness ...," are to receive "...stable General Fund and Tuition budgets over the next three years and priority for new resources."[1] [Emphasis added]

  (In a separate section on the Avery Point campus, the plan does recommend that the "graduate programs in marine sciences, and the research and science activities of the Sea Grant Program, should have the highest priority for growth and development at Avery Point".[2] The report stresses the need to "obtain the external base funding necessary to assure strength in these areas." No mention of UCONN funding is made in this context.)

- o A recent statement prepared by UCONN officials in response to inquiries arising out of this study[3] does not suggest that marine sciences have become a UCONN priority. Although the statement examines a number of possible external funding sources, it appears to assume that major funding will not be forthcoming from the University.

- o Finally, although UCONN has successfully responded to some of the recommendations of an important 1980 report calling for increased state commitment to the marine sciences, other recommendations remain unimplemented. The report[4] by Connecticut's Board of Higher Education (BHE), recommended

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[1] Office of the Vice President of Academic Affairs, UCONN, Draft, Opportunities for the 80's, Recommendation No. 16, April 6, 1983. The twelve "Programs of Exeellence" are the departments of animal genetics, communication sciences, economics, history, linguistics, metallurgy, nutritional sciences, and psychology; the Schools of Law and Business Administration; and the biological sciences group.

[2] Ibid. note 1, Recommendation No. 71.

[3] UCONN, Drs. J. Baird, A. DiBenedetto, S. Feng, L. Katz, V. Scottron, "Development of Avery Point Into A Major Marine Center", May 31, 1983.

[4] Connecticut Board of Higher Education, A Study of the Feasibility of Establishing A Maritime Academy and Expanding Marine Sciences Activities in Connecticut, 1980.

measures such as increased state financial support for the marine sciences; pursuit of other, particularly Federal, sources of funding; and formation of a BHE advisory committee on the marine sciences. In keeping with these recommendations, UCONN has successfully secured "coherent project" status under the Federal Sea Grant Program and has obtained enough additional state funding to match the Federal funds. Since the report, however, no new faculty positions have been added in the marine sciences (although one non-faculty staff position was added), and facilities have not been significantly improved. Nor has BHE established the recommended advisory committee on the marine sciences.

If UCONN has little money for innovations and has other priorities higher than expansion of marine sciences, do any chances remain to secure start-up funding for that expansion? We explore this difficult question in the "Postscript" at the end of our report.

Continuing institutional support ("hard" operating funds). As already noted, start-up funds are only part of the funding picture. A major university-linked marine sciences center also depends on two kinds of operating funds: "hard" funds provided by the sponsoring institution (such as UCONN) and "soft" funds in the form of external grants and contracts.

At the largest centers, hard funds represent only 20 or 25 percent of the total program budget; grants and contracts account for the remaining 75 or 80 percent. For small centers, the percentage of hard funding is likely to be much higher -- sometimes as high as 60 percent of the overall budget.

The exact amount of sustained hard funding needed for a major center at Avery Point must remain conjectural at this point. Applying the experience of other major centers, however, we estimate that a major center at Avery Point would need hard funding for about 25 percent of its budget. For a center with an annual budget of $6 million, support at the 25 percent level would come to $1.5 million. This compares to present UCONN support of the Avery Point complex of roughly $938,000. (See Appendix 2.)

For an Avery Point center linked to UCONN, this institutional support would need

to come through UCONN. As a practical matter, since this support (unlike start-up funding) must be provided indefinitely, it must almost surely come from UCONN's own budget. The needed increase in hard funding would be substantial, given UCONN's difficult economic circumstances, although not nearly so large as the needed increase in external grants and contracts.

External grants and contracts ("soft" operating funds). As already suggested on the basis of the experience of existing major institutions, external grants and contracts should (after the start-up period) provide roughly 75 percent of the annual operating budget of a major center at Avery Point. Thus, if the needed total budget is $6 million, external grants and contracts should total $4.5 million annually. This represents an increase of roughly $4 million over the $561,000 in external grants and contracts received in FY 83 by the UCONN marine sciences operations at Avery Point.

To obtain this seven-fold increase in soft funding, a major center at Avery Point would face intense competition from established centers. External grants and contracts to major university-linked marine sciences centers come in large part from Federal sources, particularly from the National Science Foundation (NSF), the Office of Naval Research (ONR), and the National Oceanic and Atmospheric Administration (NOAA).[1]

NSF. The National Science Foundation is by far the largest Federal source of oceanographic research awards. In FY 81 it awarded some $96 million for this purpose, about 37 percent of all Federal obligations for research in oceanography. In FY 82, it awarded $97.3 million, of which $95 million (97 percent) went to ten institutions. A total of $31.3 million (32 percent) went to three institutions in the Northeast[2]: $19.3 million to Woods Hole Oceanographic Institution, $7.1 million to Lamont-Doherty Geological Observatory, and $4.9 million to the University of Rhode Island.

The funding level of NSF's oceanography division increased 2.4 percent from FY 81 to FY 82 and 5.1 percent from FY 82 to FY 83. Both increases were less than the annual rate of inflation.

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[1] Sources of this information on Federal grants are given in Appendix 2.

[2] The northeast region, as used in this report, uses the U.S. Census' definition of Northeast which includes the following states: Pennsylvania, New Jersey, New York, Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, and Maine.

ONR. The Office of Naval Research accounted for some $34.4 million in grants and contracts for oceanographic research in FY 81, about 13 percent of all Federal obligations for that purpose. In FY 82, the ONR oceanographic budget to academic institutions was $42.8 million of which $29.9 million (approximately 70 percent) went to ten institutions. This included $12.3 million (28 percent of total ONR grants and contracts) to the same three institutions in the Northeast: Woods Hole received $6.5 million, Lamont-Doherty $4.2 million, and URI $1.6 million.

The ONR funding level has fluctuated widely in the 1980's. In FY 80 about $52 million was made available to colleges and universities for oceanographic research. In FY 81 this figure dropped to $34 million. In FY 82 it bounced back to $42.8 million and is estimated to be $44 million for FY 83. This 1983 total is still almost 16 percent below the 1980 budget.

NOAA. The National Oceanic and Atmospheric Administration accounted for some $59.2 million in grants for oceanographic research in FY 81, about 23 percent of all Federal obligations for that purpose. The major NOAA programs awarding these grants are:

Sea Grant. Sea Grant, by far the largest of these NOAA grant programs, supports a wide range of research, educational, and outreach programs on coastal and oceanic resources. In FY 81, total grants to institutions came to almost $40 million. Of this total, $8.8 million (22 percent of the Sea Grant total) went to 11 institutions in the Northeast.

Saltonstall-Kennedy. This program provides grants and cooperative agreements for research and development projects on commercial and recreational fisheries. The average grant size is approximately $100,000. Awards are available to any regional fisheries development foundation, academic institution, industry, NMFS research laboratory, state and local government, or other non-profit group. Approximately 50 percent of all awards are made to regional fisheries development foundations, which in turn may award S-K funds to universities, industry and others. Total grants in FY 81 came to $8.8 million. Of this, the New England Fisheries Development Foundation received approximately $1 million; breakdown by university is not available.

National Undersea Research Program (NURP). This program provides grants for undersea research facilities for understanding and management of marine resources. In FY 82 the total NURP budget available to academic institutions was $2.9 million. Five academic institutions received over 91 percent of these funds for undersea facilities: Woods Hole Oceanographic Institution, $946,000 (for the ALVIN -- national facility at Woods Hole, Massachusetts); the University of Hawaii, $860,000 (Makapoo, Hawaii); Fairleigh Dickinson University, $529,000 (for facility at St. Croix, U.S. Virgin Islands); University of North Carolina, $200,000 (Wilmington, North Carolina); and the University of California, $115,000 (Catalina Island, California).

The future availability of NOAA grants for academically-linked marine centers is hard to predict with confidence. The Administration has requested elimination of all three of these programs, but Congress maintained them by continuing resolution for FY 82 and FY 83; for FY 84, no decision has yet been reached.[1]

Clearly, the present Federal funding climate is not an auspicious one for starting up a major new marine research center. Most major centers have reported increased difficulty finding grants to support their research, and competition for available grants has intensified. As Dr. William A. Nierenberg, Director of Scripps Institution of Oceanography, the nation's largest academic oceanographic center, observed in a recent report:

> "Given the financial stringency of the times and the heavy external budget restrictions...we anticipate rough financial going in the next several years...and some retrenchment will be required. There are also severe perturbations imminent in the federal funding of the oceanographic effort... There are many new initiatives we would like to entertain in the coming year, but decisions will have to wait until the financial picture is clearer."[2]

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[1] In addition to providing grants through the programs listed in the text, NOAA itself operates an array of marine science laboratories and research facilities, including several in the Northeast. Facilities operated by the National Marine Fisheries Service (NMFS) are located at Gloucester and Woods Hole, Massachusetts; Narragansett, Rhode Island; Milford, Connecticut; and Highlands, New Jersey. NOAA also operates one of its environmental research laboratories, the Geophysical Fluid Dynamics Laboratory, in Princeton, New Jersey. (See Table A2-7.)

[2] University of California, San Diego, Scripps Institution of Oceanography 1982, vol. 16, number 1 (January 1983).

Of course, present conditions may change. The pool of external grant funds could grow significantly by the time that an expanded Avery Point center would need to depend on them. Nevertheless, prospects for a new institution to break into the big leagues are currently bleak.

Leadership

Leadership is the second critical element of any strategy for developing Avery Point into a major marine science center. At present, UCONN's Marine Sciences Institute does not have a full-time administrator as director. Instead, direction of MSI is the responsibility of Dr. Sung Y. Feng, who is also the acting Chairman of the Marine Sciences Department, thus burdened with administrative work in addition to having teaching and research responsibilities.

The recent statement by University officials on "Development of Avery Point into a Major Marine Center"[1] recognizes that as the spending pattern of the center increases, so will its administrative needs. The report recommends that as marine activities grow at Avery Point, a "senior director" be appointed to whom "other unit directors would report."

So long as the absence of UCONN funding blocks expansion of Avery Point into a major center, there is no compelling reason to change the present administrative structure. In the future, if there is a reasonable prospect of funding by UCONN, reorganization to provide additional leadership will be essential to implement a growth strategy. As part of such a future reorganization, we concur in the University officials' recommendation that a "senior director" be appointed for marine activities at Avery Point. A clear administrative hierarchy also needs to be defined that establishes the relationship of all existing and proposed units.

Institutional Mission

The third critical element of any strategy for developing Avery Point into a major marine center is a clearly defined mission for the expanded center. The

[1] UCONN, Drs. J. Baird, A. DiBenedetto, S. Feng, L. Katz, V. Scottron, "Development of Avery Point Into a Major Marine Center", May 31, 1983.

mission may be only broadly defined at the outset of the expansion process; a more detailed statement of its mission will emerge in response to changing needs and the interests of an expanded staff. Even at the outset of the expansion process, however, a general understanding of the center's mission is essential to focus the energies of its leadership and to persuade the outside world, notably funding sources and potential faculty and students, of the center's potential.

Ideally, the center's mission would respond to significant needs that are already identified as not being met. In an attempt to identify such needs, as perceived by current beneficiaries of Avery Point services and by the marine units at Avery Point themselves, extensive interviews were conducted. (See Appendix 3.)

From the standpoint of helping to formulate the institutional mission of an expanded center, the interviews were inconclusive. Most of the respondents identified no compelling needs warranting redefinition of the present focus of the marine activities at Avery Point. Rather, the needs identified by current users of Avery Point services were the ones that UCONN at Avery Point is already addressing. These included: water pollution, commercial fisheries, cooperative marine education and research, marine business and economic advice, dredge spoil disposal, and net, gear, and navigational technology.

It is of course possible that major unmet needs do exist, but were not identified by the current "user groups". These users may not be sufficiently aware of their own future needs, or they may look to Avery Point only to perform the kinds of services it already performs. A few people interviewed noted the availability of services from larger centers nearby: the University of Rhode Island, some 40 miles from Avery Point; SUNY at Stony Brook, New York, 50 miles across Long Island Sound; and two of the largest university-linked centers in the nation -- Woods Hole in Massachusetts and Lamont-Doherty in New York -- within 120 miles of Avery Point.

In an effort to identify expansion opportunities not suggested by our inital survey (the research approach specified by our contract), we interviewed others. These subsequent discussions focused less on needs and more on opportunities. Two interesting suggestions for Avery Point resulted:

o High Technology as a Focus for Future Research

Some people interviewed suggested that UCONN explore opportunities to develop a new speciality within marine sciences to complement its existing strong capabilities in coastal and environmental research. Such research might, for example, relate to innovative marine science technology involving electronic measurement and data transmission, data analysis models and protocols for processing data on a real time periodic basis, new instrumentation methods, robotics, and new technologies associated with the further development of chemical, physical and geological/geophysical oceanography. High technology research, it was suggested, would allow the University to utilize faculty in other departments, such as engineering and computer science, which are likely to receive higher priority for University funding support. Computer sciences, in particular, is likely to receive emphasis because industry in Connecticut is becoming heavily dependent on computer technologies.

o Capitalizing on Avery Point's Location Amid a Unique Array of Government and Private Sector Marine-oriented Activities

Several people interviewed suggested that there must be a need for Avery Point programs to serve as a catalyst or coordinator or nucleus for the many major marine-related installations in its immediate vicinty. Somehow, it was repeatedly suggested, Avery Point should be able to pursue mission areas related to support of the major Federal installations (Naval Submarine Base, Medical Research Lab. and Underwater Systems Center), and major marine industry (notably Electric Boat).

Even though these suggestions were repeated during our interviews, neither we nor those we interviewed have succeeded so far in translating these appealing concepts into specific mission elements for an expanded marine sciences program at Avery Point. No "niche" for an expanded Avery Point center has become clear, nor any way to overcome the obstacles to cooperation created by military security requirements, under which many of the marine activities in the area necessarily operate (including, for example, nearly all the R&D activities at Electric Boat, as well as the work of the Naval Underwater Systems Center).

In the future, when funding obstacles have been overcome, further exploration

of these suggestions may contribute to the formulation of an institutional mission for an expanded center. Until UCONN's funding difficulties show some prospect of being surmountable, however, there seems little reason to pursue such exploration in depth; the results would probably be out of date by the time they are needed.

Because of poor funding prospects, particularly for UCONN funding, coupled with the absence of a compelling mission for an expanded center, we conclude that the most reasonable strategy for the marine sciences at Avery Point is essentially the one that the marine sciences staff at Avery Point are already pursuing: to seek modest growth by incremental steps. This strategy is consistent with the University's overall plan and funding perspectives. Moreover, there are opportunities for such growth.

OPPORTUNITIES FOR INCREMENTAL GROWTH OF MARINE SCIENCE UNITS AT AVERY POINT

The prospects for incremental expansion of the marine sciences program at Avery Point depend to a great extent on where its activities are focused. For example, with regard to graduate education, the Department of Marine Sciences has been able to award degrees in all four of the major specialties within oceanography: marine biology, marine geology and geophysics, physical oceanography, and chemical oceanography. But approxiately half of its degree graduates were in the marine biology specialty, a field where the supply of graduates may already exceed employment demand.[1] In contrast, the demand for chemical, physical, and geophysical oceanographers exceeds the supply. Thus a different balance with regard to faculty specialties and curriculum might yield a higher level of graduate student applications in future years and be more responsive to the present oceanographic training requirements of the country.

The Marine Sciences Institute has evolved a strong focus on coastal marine resources and environmental issues over the years. Thanks to a sustained amount of research contracts and grants concerned with dredge spoil, coastline dynamics and trace metals analysis, the Institute has achieved strong research capabilities in these topical areas. Government agencies, private businesses and other organizations, especially those with an orientation to Long Island Sound, have research needs which have undoubtedly influenced the scientific interests and capabilities of the Institute's staff. Defining research missions which build on the core of its accomplishments, and obtaining new clients and sponsors who can support these and related missions, is required to achieve an expanded scale of research activity at the Institute.

Given the fact that other academic marine science centers in the northeast have substantial deep ocean research agendas, and sponsors to support them, maintaining the Institute's current emphasis on coastal oceanography may well be the most effective strategy for planning its future research directions.

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[1] University of Connecticut. Institute for Social Inquiry, Storrs. The Federal Funding of Academic Marine Science: Final Report. Prepared by Wayne W. Shannon and David D. Palmer, 1982, page 187.

Undersea Research

In seeking to broaden its research role, the Marine Sciences Institute has initiated planning for a potential new program which has implications for its future research capabilities and agenda. In August 1982, the Marine Sciences Institute, Sea Grant Office and Marine Advisory Service sponsored a planning session on undersea research systems in the Northeast region. Representatives from marine science research centers in New Jersey, New York, Connecticut, Rhode Island, Massachusetts, New Hampshire, and Maine, and staff from NOAA's Undersea Research Program and Office of Policy and Planning met to discuss undersea research topics and facility needs. Also participating were representatives from the NOAA-NMFS Northeast Fisheries Center in Woods Hole and the NOAA-NMFS Narragansett Laboratory. Subsequently, the Marine Sciences Institute submitted a letter of intent to the NOAA National Undersea Research Program (NURP) Office indicating its interest in developing a proposal for an undersea research program to serve the research missions of the northeast marine science institutions. Currently, this preliminary proposal is under review by the NURP Office of NOAA.

The proposed program would focus on issues of marine pollution, fisheries stock assessment, habitat identification and protection, fishing gear performance and marine ecosystem knowledge. The use of new undersea inspection technology and leasing of existing submersible equipment would be considered. The proposed emphasis would be on benchmark studies, monitoring and assessments of ocean floor biota, habitats and contaminants. Pending development of offshore oil production may lead to many new engineering and environmental research opportunities. Because of its work in dredge disposal site monitoring, the Institute has made extensive use of in situ research techniques. Marine science units at Rutgers and the University of New Hampshire also have maintained an interest in undersea research methods. Different organizational arrangements would have to be evaluated, including a consortium approach, but the University of Connecticut's marine science units at Avery Point are prepared to lead a cooperative effort with other Northeast marine science centers to obtain initial funding from NOAA to organize and design a trial series of undersea research missions.

Precedent for a consortium approach to undersea research is provided by the Southeast Undersea Research Facility (SURF) at Wilmington, North Carolina. SURF is sponsored by SECURE, the Southeastern Consortium for Undersea Research

Efforts, which is composed of several colleges and universities in the southeast. SURF receives funds from NOAA's National Undersea Research Program.

Aquaculture Research

During the early part of the 20th century, the shellfish industry in Connecticut was a major economic activity. Oyster beds near Bridgeport and other locations produced seed oysters that were shipped throughout the east coast. Water pollution and other factors affecting oyster production have reduced the size of the industry. However, Connecticut has begun efforts to develop shellfish resources through its Aquaculture Division, its proposed Aquaculture Commission and other agencies. Dr. Robert B. Whitlach at the Marine Sciences Institute is conducting research which will experimentally examine the population dynamics of the hard shell clam and apply the resulting data to the development of effective resource management policies. His two-year research project began in July 1982. It is funded by NOAA Sea Grant funds, with matching support provided by the University and two commercial shellfish companies in Long Island Sound. The basic purpose is to determine the commercial feasibility of clam farming techniques in Southern New England.

A logical outgrowth of its current research on the hardshell clam would be for the Marine Sciences Institute to direct some of its research skills toward solving some of the predator and disease problems which currently restrict the growing of oysters and clams as a business in Long Island Sound. Predators such as starfish and drills, and diseases such as MSX as well as water pollution, curtail oyster production not only in Long Island Sound but other producing areas such as Great South Bay, Long Island, Delaware and Chesapeake Bay. From the perspective of the few large commercial oyster businesses in Long Island Sound, future research on oyster cultivation would be most useful if the research results were readily transferable into commercially applicable improvements in production methods. Applied research is as necessary as basic research if any appreciable growth in commercial shellfish production is to be achieved in Connecticut.

The Potential for New Joint Educational Programs

Because of the University's marine science program is the largest in Connecticut, the Department of Marine Sciences has begun to examine possible ways in which its

educational programs could be expanded by cooperative arrangements with other educational institutions in the State or Long Island Sound region. Both extension courses and credit courses are being considered. Pooling of available personnel and facilities is one approach to expanding curriculum economically. The Department has discussed possibilities for a joint program with the Depart- of Zoology and the Department of Botany at Connecticut College. Other institutions that are to be approached by the Department include Mitchell College, Eastern Connecticut State College, the U.S. Coast Guard Academy, Mystic Seaport and Mystic Marinelife Aquarium. In addition, there are possibilities for a special summer program for several colleges in Massachusetts, including Amherst and Smith, which may be able to make arrangements to use the faculty and facilities at Avery Point. Planning of multi-institutional programs of marine science education, research and advisory services is a primary function of the Connecticut Sea Grant Office at Avery Point. The Department of Marine Sciences has an immediate opportunity to create educational programs with other interested colleges and institutions in the region. Together, the Department and the Sea Grant Office could provide the leadership in implementing new cooperative methods of offering courses on a variety of marine science topics.

Marine Advisory Service and Its Future Role

Since the establishment in 1974 as part of the University of Connecticut Cooperative Extension Service, the Marine Advisory Service at Avery Point has been able to develop a core staff of extension agents who provide technical information and management assistance to marine-related industries, local governments and citizens groups. This program received $60,000 in direct financial support from the State Legislature, as well as NOAA Sea Grant funds, indicating that its conferences, demonstrations, short courses, publications, and management assistance activities have gained legislative support and public recognition. Its goal for the future is essentially to encourage the application of new knowledge and techniques in order to enhance the economic performance of marine industries, and to promote the optimum use of marine resources in coastal communities.

The Marine Advisory Service has accomplished a variety of extension activities with the assistance of NOAA financial support. Appendix 3 details some of these accomplishments.

The Marine Advisory Service has selected four major areas of concentration for its future work, namely fisheries, aquaculture, environmental quality and marine recreation. It seeks to expand its technical assistance to marine businesses with regard to seafood marketing and distribution, financial management, and the creation of State policy and incentives for the development of aquaculture. Anticipated enactment of the Connecticut Aquaculture Commission Act would create new requests for assistance from the Service. Since the purpose of the proposed Commission is to establish and implement aquaculture research and development policy, it will require technical help from the Service and other sources. This assistance will be facilitated by a provision in the Act specifying that one of the members of the proposed Commission shall be a representative of the Marine Advisory Service.

Thus, the Marine Advisory Service's future role lends itself to a gradual expansion from its presently established level of activity. Provision for future increases in the level of technical assistance will probably necessitate new personnel in addition to the existing staff of three professionals.

NOAA has recently emphasized its service capabilities and has sought to find improved ways of delivering the full range of its services to interested user groups and the general public. As the principal Federal agency responsible for the collection, analysis and dissemination of information on the ocean and atmosphere, NOAA's constituent organizations such as the National Weather Service and the National Ocean Service, may in the future organize more decentralized methods of serving user groups and the general public. One option for NOAA could involve expanded use of the Marine Advisory Service programs in each state as a focus for outreach to users of various NOAA products. The Connecticut Marine Advisory Service already works closely with the NOAA-NMFS Northeast Fisheries Center in Woods Hole and its Fisheries Lab in Milford, Connecticut, on fisheries resource management issues. Thus, any future increased emphasis by NOAA's central administration on transmitting NOAA information and products to user groups, could augment the role and operations of the Marine Advisory Service. It is too early to know what specific administrative innovations may occur within NOAA in relation to outreach programs, but the Marine Advisory Service system offers a potentially effective mechanism for implementing NOAA initiatives. Avery Point might serve to establish and evaluate techniques and procedures as part of a NOAA-sponsored pilot study.

Technical Training as a Service to Industries in the Region

UCONN has an opportunity to extend its graduate programs at Avery Point to serve the needs of the region's businesses. One of its tenants, the Hartford Graduate Center, already offers graduate degree programs in business administration and computer sciences directed toward employees of firms in the region. The University of New Haven runs a program of technical courses to which Electric Boat and other firms send personnel for training in management and engineering fields. The University of Connecticut has the physical facilities at Avery Point, and the capacity to use faculty in engineering, business and other fields from its different graduate and undergraduate departments at Storrs, as well as the faculty already teaching extension courses at Avery Point. These resources could be directed toward offering specialized training, ranging from technical seminars and short courses to series of courses, for scientific, technical, business and administrative personnel working in the region's industries.

The curriculum could be designed to meet the subject area emphasis desired by the firms involved. Curriculum topics may include emerging new techniques and knowledge which applies to a cross section of industrial firms in the region. Many firms employ technical staff whose effectiveness depends on applying new methods in rapidly evolving engineering and production specialties. For example, Howmedica, a Pfizer subsidiary, has opened a new research facility in Groton concerned with manmade surgical implants. Many smaller firms in the region are involved in various aspects of advanced information and communications sciences which may produce needs for staff training which the University of Connecticut could provide at Avery Point.

Although marine science instruction could be offered to business employees in the region, the greatest demand is probably in physics, math, information sciences, and other scientific and technical specialties. Thus, the total faculty resources of the University could be drawn upon in order to offer the kinds of courses and special curriculum relevant to the training needs of the scientific and technical personnel of the numerous business firms located in the Southeastern Connecticut region.

The Electric Boat Division of General Dynamics, although it is the region's largest single employer, exemplifies some of the potential for training adult workers.

According to one company official, 180 of the company's employees are enrolled in courses in business administration and computer sciences at the Hartford Graduate Center program at Avery Point. Employees also take courses at the University of New Haven units in New London and at Electric Boat's plant. The official said his company is interested in training at three levels: degree programs in electrical and mechanical engineering, non-degree short courses in rapidly evolving scientific and technological fields, and seminars on specialized technical topics related to their business operations. He felt that the University of Connecticut, as a public institution with its own campus facilities at Avery Point, should be in a strategic position to expand business employee-oriented course offerings in the future.

POSTSCRIPT: A JOINT STATE-FEDERAL COMMITMENT TO CREATE A MAJOR CENTER AT AVERY POINT?

Modest growth through incrementalism does indeed seem the most realistic approach to growth of the marine sciences at Avery Point under present circumstances. As already explained, UCONN has little money for expansion and priorities for spending it do not include the marine sciences. No current Federal program appears to have potential for providing start-up funds. Even after start-up, prospects are not bright for securing the millions of dollars of new grants and contracts that are likely to be needed each year for operation of the new center. So much for what has already been explained.

Now, set aside "realistic" constraints for a moment. Consider instead the case in which an a priori joint State-Federal commitment is made to establish a major marine center at Avery Point. The following steps would need to be taken:

1. Joint decision is made, in principle, to try to establish a "new" major center at the Avery Point site (e.g., UCONN and NOAA or USCG).

2. A panel or workshop is convened to plan a model program for an education/research/service mix tailored to the perceived needs and aspirations of the state and the participating Federal agency.

3. The essential components of the model program are identified along with a skeletal management structure, critical staff positions, and essential facilities.

4. A minimum-maximum cost analysis is conducted with respect to Item 3.

5. The initial costs are split in some negotiated proportion (but not too far from 50-50) for state and Federal resources. (The involvement of the private sector here and earlier is, of course, also a possibility, but private demands may be too specific and too rigid.)

6. Representatives of each element seek to raise their share of the start-up costs. The monies of each are only committed when both (all) parties can generate their share of the whole package. Neither party is obliged to anything unless both are able to confirm their funding commitment.

Why even consider this possibility? For two principal reasons:

- o First, the possibility, however remote, of extraordinary State funding for a State-Federal center. Connecticut legislators, after stressing to us that the State budget is extremely tight and that UCONN is unlikely to get additional funds, went on to mention that bond issues are always a possibility for projects that have sufficiently strong support.

  To receive legislative support, a proposal for Avery Point would need to hold prospects for creating jobs and for diversifying the economy of southeastern Connecticut, which is highly dependent on Electric Boat. Some indication of actual or potential Federal commitment and financial support of the proposed development would significantly strengthen legislative support.

- o Second, the possibility, even though also remote, that the needed Federal commitment might indeed be forthcoming. There are many precedents for joint State/Federal financial commitments to acquire major new facilities, including buildings, docks, ships, and laboratory equipment. Two such precedents have already been noted. At the University of Miami, the Rosenstiel School of Marine and Atmospheric Science has joined with NOAA to establish a Cooperative Institute for Marine and Atmospheric Studies; the Institute links the Federal and academic oceanographic laboratories for research of mutual interest. And at Princeton University, NOAA has established a Geophysical Fluid Dynamics Laboratory, which operates a research program collaboratively with the University.

Such joint ventures are normally marriages of convenience; the recognition that a suite of common or overlapping scientific interests can best be realized by pooling resources, sharing responsibilities, and broadening one's promotion base. Is there a base for a marriage of convenience at Avery Point? Our interviews and analysis have not turned up such a basis. Still, the Coast Guard does have its major R&D Center on the site, with an operating budget of roughly $5 million this year, and the Connecticut General Assembly has already made clear its willingness to provide bond issue funds to provide the Center with permanent quarters. And the site is, as repeatedly noted, strategically located to serve a unique concentration of Federal marine-related institutions and private marine-related industries. The possibility, however elusive, of forging a joint commitment has seemed great enough to warrant this Postscript.

APPENDIX 1

APPENDIX 1: THE AVERY POINT COMPLEX TODAY

INTRODUCTION

Avery Point is a 42-acre promontory on Long Island Sound near the mouth of the Thames River. It is within the City of Groton, near the City of New London, Connecticut. The New London-Norwich area provides non-agricultural employment for 95,610 people, much of which is marine based.[1] Groton is the home of the U.S. Navy's major east coast submarine base as well as the home of the Electric Boat Division of General Dynamics, builder of nuclear powered submarines.

The State of Connecticut, which holds title to the land at Avery Point, has given the land to the University of Connecticut for its Southeastern Campus. In addition to the 42 acres on Avery Point, the State owns an 18-acre parcel adjoining the property on Shennecosset Road and Pine Island, approximately 13 acres, which is situated one-quarter of a mile south of Avery Point. The University administers a variety of programs on this site, and rents space to related agencies which contract with the University for the use of Avery Point facilities (U.S. Coast Guard and Project Oceanology). The programs offer a variety of technological, research, educational, and outreach services to the nation, the State, and the Groton-New London region. They include:

A. U.S. Coast Guard Research and Development Center
B. University of Connecticut at Avery Point (general programs)
C. Marine Sciences Institute
D. Marine Sciences Department
E. Sea Grant Program
F. Marine Advisory Service
G. Project Oceanology
H. Hartford Graduate Center

(See Table A1-1, page A1-19, for the overview of marine related activities at Avery Point - includes personnel and budgets.)

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[1] Source: New London-Norwich Quarterly Labor Market Review, April, 1983, p. 3, Connecticut Labor Department. Data is for non-agricultural wage and salary employment in the New London-Norwich Labor Market Area by place of work for March 1983.

A. U.S. COAST GUARD AT AVERY POINT

The Coast Guard's Research and Development Center is a significant institution within the complex of institutional facilities at Avery Point. Although its primary activities are dedicated to the regulatory and operational programs of the Coast Guard, its budget, facilities, staff and orientation give it a broader scope in research, development, testing, and applied technology.

Professional Staff

The Center currently has a budget of $5 million and a total staff of 112, of which 57 are scientists, engineers and technicians. The staff is expected to increase to 152 by the end of the year. Approximately 50 percent of the total staff are civilian personnel. See Table A1-2, page A1-20, for a description of the Center's organizational structure. The Center's staff includes seven chemists, six electronics engineers, six ocean engineers, four oceanographers, six marine systems specialists, three physicists, and 25 technicians.

Facilities and Equipment

The facilities and equipment for research include advanced instrumentation for the study of marine pollution in a mobile laboratory with communication and data transmission capability, an optics laboratory, environmental chambers for ice technology research, automated radar contact tracking capabilities for vessel traffic services applications and broadbased computer facilities. The Center also operates a test tank, solar energy testing equipment, and a machine shop.

Programs

The R & D Center's activities are focused on 5 core technologies, in which staff, expertise and equipment have been developed. These technologies center on marine pollution technology, marine fire and safety research, marine navaids, domestic and polar ice technology, and marine traffic management systems. (See Table A1-3, page A1-21, for summary of R&D Center activities.)

The Marine Pollution Technology Program is interdisciplinary in nature, including chemistry, oceanography, physics, biology, electronics, and naval and ocean

engineering. These disciplines are applied in concert and directed towards end product development needs. An exemplary result of the Center's marine pollution research is the tracing of oil spills through "oil fingerprinting".

Other projects in the area of marine pollution include: local area surveillance system, pollutant identification system, hazardous chemical discharge preventions and reduction, and pollution response instrumentation. These projects have produced end products such as the local-area remote sensors for pollutants.

The marine NAVAIDS program, although unique to Coast Guard needs, engages in research which involves scientific and engineering and disciplines of value to the academic research and industrial community. The major disciplines involved are physics, electronics, chemistry and civil, naval, mechanical and ocean engineering. The major end product elements are buoy design and buoy power sources which includes work on solar cell design.

The domestic and polar ice technology program includes research in physical oceanography, meteorology, physics, electronics engineering and naval architecture. The Center is involved in polar ship routing which demands application of the disciplines associated with ice physics, glaciology, thermodynamics and instrumentation.

The marine fire and safety research program necessitates support in interdisciplinary marine chemical engineering as well as sophisticated analysis of marine accidents.

The marine traffic management systems work includes all technologies and disciplines associated with the hardware, software and traffic management techniques necessary for vessel traffic, data collection, and analysis and computerized detection, tracking, and display systems.

Current Relationships with University Units at Avery Point

The Center's relationships to other units at Avery Point is mainly through cooperative staff arrangements. A physical oceanographer from the Center serves as a visiting faculty member at the Marine Sciences Department. Some of the scientific staff from the Center teach in the undergraduate program at Avery Point. The Center contributed financial support to a special seminar series in current marine research activities at the Marine Sciences Institute in 1982.

Joint research projects are a potential prospect for the future. The Institute is interested in creating such efforts, but to date no joint research projects have been organized. The Center uses the Institute's library collection and, at times, its docking facilities.

Plans for the Future of the Coast Guard R & D Center

Plans for the Coast Guard Research and Development Center call for adding 40 staff members over the next year. The new staff members will be mostly scientific and technical personnel distributed among the technical branches.

The Center does not have any current plans for major physical improvements of the facilities which it leases from the University. Interest has been expressed in improved docking facilities at Avery Point. A new one-year lease, renewable for five years, is currently being negotiated between the University and the Coast Guard. Thus, it is probable that the Center will remain at Avery Point for the near future.

In 1981 the Connecticut General Assembly authorized a $10 million bond issue for the construction of a new building for the Center at Avery Point on a lease-purchase basis, because the Coast Guard was considering the possibility of moving the Center to a U.S. DOT facility in Massachusetts or to Delaware. Because of budget constraints the Coast Guard has not made any final decision on the bond issue offer, nor is it likely to relocate from Avery Point in the near future.

B. UNIVERSITY OF CONNECTICUT AT AVERY POINT

The 42-acre Avery Point campus was originally part of financier Morton F. Plant's estate. Plant built Branford House (now a convention center) as his country home. In 1941 the State of Connecticut purchased the property from Mr. Plant's heirs, then passed the title onto the Federal government who established a U.S. Coast Guard training center on the land. In 1966 the Coast Guard moved their training operations to Governor's Island, New York, and the title to the land reverted back to the State. They, in turn, transformed the former Coast Guard facility into what is today the University of Connecticut's Southeastern campus at Avery Point.

General Description

As the University's southeastern campus, Avery Point serves as a regional educational center offering selected graduate and undergraduate courses as well as offering certificate (non-credit) courses through the University's Division of Continuing Education. The regional campus brings to the New London area a comprehensive two-year Freshman-Sophomore program, offering 72 separate courses. Any baccalaureate program of the undergraduate schools and colleges may be initiated at the campus. The Bachelor of General Studies program permits students to pursue work in the Upper Division leading to a baccalaurate degree. Extension courses, certificate programs and other opportunities for non-degree students are also offered.

Overall, there are approximately 650 undergraduates utilizing the Avery Point campus. Enrollment has increased in recent years, including an increase in the number of non-matriculating students. Approximately one-third of the students are adults from the region seeking continuing education. Hence, the evening program has been enlarged as have upper and lower division course offerings. Programs, either with credit or non-credit courses, for the region's large technical community are being considered for engineering, computer science, and other fields.

Facilities

The campus facilities are housed in 10 buildings which provide space for classrooms, laboratories, library, gymnasium, a student center, a theater, and

offices for administration. (See Table A1-4, page A1-22.)

Budget

The operating budget for the University's undergraduate programs at Avery Point was $1,563,000 in FY 1983.

Faculty/Staff

Faculty consists of 16 full-time members and 36 part-time teachers. Since 1976, full-time faculty has decreased by 25 percent, while part-time staff has increased substantially.

Relationship to Other Units

Following successful completion of the two-year program at Avery Point, students may transfer to the main Storrs campus of UCONN to complete their baccalaureate programs.

C. MARINE SCIENCES INSTITUTE

General Description

In 1957 the Marine Biological Laboratory (MBL) opened in Noank as a summer research facility for University of Connecticut faculty, primarily to conduct studies on marine vertebrates and marine algae in Long Island Sound. In 1963, the MBL received its first resident faculty member, a marine ichthyologist. The laboratory was expanded in 1966 to three resident faculty members, specialists in marine microbiology, geology, and shellfish.

The Marine Sciences Institute (MSI) was established in 1968 and is the core of marine science graduate programs and marine research at Avery Point. Two years later the MSI at Avery Point and MBL in Noank merged. For the following nine years, MSI would serve the dual purpose of a research institution and an educational body for the University. A report published by the University's Marine Sciences Committee in May 1975 recommended that the "Institute be reconstituted with departmental status".[1] In 1979 the recommendation was acted upon and the MSI was reorganized, thus creating a Marine Sciences Department as well as a research institute. By separating the functions, the University felt it "would allow the Institute to pursue its own goals of research coordination, garnering of funds and maintenance of diverse research facilities free of the nagging sense of short-changing the academic program".[2] (See Table A1-7, page A1-25, for overview of Institute's development.)

Budget

The Institute has obtained $2.6 million in research contracts and grants over the past five years. (See Table A1-5, page A1-23.) Forty-three percent of this was from the U.S. Navy, 31 percent from other Federal agencies, 17 percent from industries, six percent from Connecticut State agencies, and three percent from non-profit organizations and University internal grants. The annual operating budget for FY 1983, obtained entirely from external grants and contracts, was approximately $409,000.[3]

Research Focus

Currently 14 active research grants and contracts are being conducted (see Table

[1] UCONN Marine Sciences Committee: Report, May 6, 1975, page 1.

[2] UCONN Marine Sciences Institute Advisory Council: Report, February 23, 1979, page 2.

[3] UCONN Marine Sciences Institute. "Active Research Grants and Contracts", April 21, 1983.

A1-6, page 24). Major research efforts have been concentrated in trace metal biogeochemical cycles and coastal environmental studies relating to dredging and shoreline dynamics in the Long Island Sound Area.

Facilities

The Marine Sciences Institute occupies two buildings with a total of 40,583 squre feet of net floor space, housing, laboratories, including a Class 100 Ultra Clean Laboratory for trace metal analysis, offices, shops, classroom, and a running salt water system.[1] The Avery Point facilities are used for research and teaching in chemical and physical oceanography, marine geology, geophysics, marine ecology, and ocean engineering.

A second facility is located in Noank, three miles from Avery Point, at the mouth of the Mystic River. It includes a building with 8,367 square feet of net floor space housing laboratories, offices, and a marine biology library. This building is used mainly for biological studies and contains a continuous flow salt water system, a well-equipped trace metal laboratory, conventional laboratory equipment for conducting fisheries and biological research, and diving facilities. A separate shop building services that boat fleet and laboratories.

The Institute has a fleet of boats docked along a 125-foot pier at the Noank facility. The fleet consists of a 65-foot T-Boat, the steel-hulled R/V UCONN, a 34-foot lobster boat, the LIBINIA, a 22-foot Aquasport, several Boston Whalers, and smaller skiffs. Personnel to man these boats are also based at Noank.

Library and Computer Facilities

The Institute's marine library on the Avery Point campus was started in 1969 and has continued to grow; it now includes more than 5,000 publications. A Harris model 1200 reader/printer remote computer terminal provides access to the University IBM 370/155/168 computer over leased telephone lines at the Avery Point location. A Hewlitt-Packard model HP 9845 computer/printer at Noank also interfaces with the University main computers.

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[1] Source: University of Connecticut, Office of Institutional Research, Fact Book, 1982-83, page 61. 1983.

Equipment

The Institute has basic research equipment used for conducting investigations in oceanography and related fields. Laboratory instruments include a gas chromatograph infra-red and UV visible spectrophotometers, atomic absorption spectrophotometers, anodic stripping equipment, and conventional equipment used in marine geological laboratories. Seagoing instruments include corers, dredges, underwater cameras and TV systems, plankton nets, current meters, a towed magnetometer, seismic air guns and sparkers, and sonobuoys.

Staff

At the time of its establishment in 1968, MSI's goal was to attain a staff of 25 researchers over a five-year period -- a goal which has not yet been met. The Institute is presently composed of 11 researchers (all of whom also act as the faculty of the Marine Sciences Department), and a 13-member support staff of technicians, secretaries, and other personnel.

Relationship to Other Units

One research project conducted by MSI is funded through UCONN's Sea Grant Program.

D. MARINE SCIENCES DEPARTMENT

In 1979, the University of Connecticut reorganized the Marine Sciences Institute creating a Marine Sciences Department as well as a research institute. This reorganization provided a clearer definition of responsibilities for research and teaching. The Department currently offers studies leading to degress in Master of Science and Doctor of Philosophy in Oceanography. A Master of Science in Ocean Engineering is offered jointly through the School of Engineering.

Budget

The annual operating budget for the Department was approximately $750,000 in FY 83.[1]

Facilities

The Department shares MSI's facilities at Avery Point and Noank.

Faculty

The Department has 11 faculty members, but only 6.5 of whom are assigned solely to teaching marine science at Avery Point. The other 4.5 spend time teaching non-marine courses to undergraduates at Avery Point or at Storrs. All department faculty are also members of MSI.

At present, 19 MS. students and 10 Ph.D. students are enrolled in various areas of the marine sciences.

Courses

The following courses are offered in the Marine Sciences Department:

GRADUATE COURSES

351 Aqueous Geochemistry
368 Marine Geology
370 Dynamical Physical Oceanography
371 Chemical Oceanography
372 Sediment Transport
376 Estuarine Circulation
377 Ocean Waves
378 Advanced Dynamical Oceanography
379 Seminar in Chemical Oceanography
395 Independent Study
397 Research
410 Special Topics in Marine Sciences
441 Ecology of Marine Invertebrates
442 Quantitative Ecology
443 Marine Systems Ecology
444 Marine Ichthyology
450 Population Ecology
461 Pathobiology of Invertebrates

[1] Source: Communication from Dr. Julius Elias, Dean, College of Liberal Arts and Sciences for estimated salaries and benefits amounting to $600,000, plus $150,000 in direct costs estimated by RMFA.

UNDERGRADUATE COURSES

135 The Sea Around Us
170 Introduction of Oceanography
236 Marine Microbiology
270 Descriptive Physical Oceanography
275 Geological Oceanography
294 Marine Biology
298 Special Topics in Marine Sciences

E. UNIVERSITY OF CONNECTICUT SEA GRANT PROGRAM AND OFFICE

In May 1980, the University of Connecticut established a Sea Grant Office at Avery Point, but it was not until July 1982 that the Office received NOAA Sea Grant funding.[1] The Connecticut Sea Grant Office administers all Sea Grant funds from the Federal government and serves as a Statewide clearinghouse for information on marine science affairs. It prepares applications for Sea Grant funding and it has established a Statewide Sea Grant Advisory Committee representing the public and private sector. This Committee sets goals and directions for Connecticut Sea Grant activities.

The Connecticut Sea Grant Office's main responsibility is to implement the recommendations of the Connecticut Board of Higher Education's 1980 report "A Study of the Feasibility of Establishing a Maritime Academy and Expanding Marine Science Activities in Connecticut". The Office is currently engaged in five major tasks which are critical to the future evolution of marine sciences in Connecticut:[2]

- Promoting innovative education programs at the undergraduate college level
- Compiling an analysis of marine-related college and university programs throughout the State
- Developing a study which will measure and describe the extent of maritime activities in the State in terms of employees, salaries, gross revenues and other factors.
- Continuing to define State needs in research areas, and relate them to regional and national needs.
- Identifying most of the promising areas of research in marine fields in Connecticut, and developing individual research proposals and advisory service projects which are high in national priorities and readily transferable to many places in the United States.

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[1] The National Sea Grant Program was begun in 1967 and is administered by NOAA. The national program aids States by providing grants which support research and extension activities on marine resources.

[2] Source: Connecticut Sea Grant Office: Revised Sea Grant Coherent Project Proposal 1982-83, Vol. 1. p. 4-5.

Facilities

The Connecticut Sea Grant Office uses two office rooms on the Avery Point campus.

Budget

In FY 1983, the first year of full operation, the Connecticut Sea Grant Office obtained a total of $250,000 in Federal Sea Grant funds, matched by $227,714 in State funds. The total Sea Grant funds were allocated to two research projects, in the Marine Sciences Institute and the School of Business Administration, to the extension program of the Marine Advisory Service, and to the administration and coordination program of the Connecticut Sea Grant Office. (See Table A1-8, page A-26, for FY 83 Budget and Table A1-10, page A1-28, for FY 84 Preliminary Budget Submission.)

Faculty/Staff

Sea Grant staff consists of the Director and an assistant.

Relationships to Other Units

In 1982-83, Sea Grant funds (NOAA funds and State match) were utilized for research activities at the Marine Sciences Institute, and for advisory services of the UCONN Marine Advisory Service.

The Director of the Connecticut Sea Grant Office coordinates applications for Federal Sea Grant funds by the Marine Sciences Institute and the Marine Advisory Service.

F. MARINE ADVISORY SERVICE

General Description

The Marine Advisory Service was established in 1974 at Avery Point as a unit within the University's Cooperative Extension Service. Its main function is to facilitate the transfer of information and technology from researchers and other sources to users such as marine operators, commercial fishermen and coastal municipal governments. It provides technical assistance on marine economics, environmental quality, fishery problems, implements educational programs through publications and workshops and conducts demonstrations on new technologies related to commercial fisheries. Specific studies and research have included aquaculture methodology for rearing scallops; shellfish physiology; techniques for the hard clam and oyster industries; marine protein resource potential; work on a major Corps of Engineers project (Disposal Area Monitoring of Ocean Spoil [DAMOS]); habitat work on the life history of the herring; marine resource inventories; port development; design and construction of fishing nets; and a marine weather program.

Facilities

The MAS offices are housed in two Avery Point classrooms.

Budget

Funded by Federal Sea Grant funds and Connecticut Cooperative Extension Service matching funds, the Service had a total 1982-83 budget of $212,693. (See Table A1-9, page A1-27, for budgets of preceeding years.)

Faculty/Staff

Staff of the Marine Advisory Service includes three professional extension agents, one of whom is the Program Leader, and four part-time assistants.

Relationship to Other Units

The Marine Advisory Service received approximately two-thirds of its funds from the Sea Grant Program. The Service relies on the Marine Sciences Institute

for scientific information in implementing its extension activities thoughout coastal communities in Connecticut. The Service has interacted with other units of the University, local fishermen, marine industries, local, State and Federal governments, as well as environmental and conservation organizations. Agencies and organizations with which it has worked include the CoE, EPA, NOAA's Marine Fisheries Labs in Milford, Connecticut, Woods Hole Oceanographic Institution, Department of Agriculture's Aquaculture Division, the CAM Office of DEP, and the Marine Sciences Institute.

G. PROJECT OCEANOLOGY

General Description

Project Oceanology is a multi-purpose marine education center located at Avery Point. The Center provides marine research and instruction facilities to a consortium of public high school systems and several colleges in southeastern Connecticut, who in return provide the bulk of the project's funding.

The project was founded in 1972 by a group of educators and community leaders in southeastern Connecticut, initially with a Federal grant through Title III of the Elementary and Secondary Education Act. Their intent was to develop a program which would foster greater awareness of Long Island Sound as a marine environment, to acquaint students with careers in the marine science fields, to encourage students in science to develop their skills through marine research, and to develop marine resource topics for ongoing projects and subjects of study.

Current projects and programs include study cruises on-board the R/V Envirolab (covering topics such as oceanography, marine ecology, fisheries, maritime history, environmental impact, and coastal management), field trips to shoreline study sites, laboratory and classroom programs conducted at Project Oceanology and in the schools, and the Pfizer Marine Research Program which provides research oriented programs after school hours and during the summer.

Programs for teachers include in-service workshops, graduate courses conducted evenings and summers leading to a Master's Degree in marine environmental education, training programs for teachers and administrators in schools with an interest in marine affairs throughout the country, and expeditions to study different marine environments.

In addition, there are programs arranged for the general public.

The breakdown of consortium members' project participation and fees imposed are included in Table A-11, page A-29.

Facilities

The project is housed in a waterfront laboratory building leased from the University. This building contains a seawater aquarium system, wave tank, classrooms, library, computer, administrative offices and well-equipped laboratories for conduting experiments and analyses. A large adjacent pier provides dockage for the Enviro-lab and other boats.

The project maintains for its use a variety of boats, including the 50' Enviro-Lab, and seven outboard boats in the 15' to 28' class; a full array of oceanographic equipment, such as nets, water samplers, bottom dredges, and assorted electronic instruments.

Budget

The Project's operating budget from members' fees for 1982-83 was $152,378.

Faculty/Staff

The project is headed by a director who also serves as instructor for the programs. The staff includes two full-time instructors, a Coast Guard licensed boat captain, a bookkeeper, and several part-time instructors during the summer months.

H. THE HARTFORD GRADUATE CENTER

General Description

The Hartford Graduate Center was founded in 1955 as an extension of Rensselaer Polytechnic Institute. The Hartford Graduate Center, Avery Point Campus, is a branch campus designed to provide graduate level instruction in business management and computer skills for the area's workforce.

In operation since 1977, the Avery Point campus currently enrolls 250 students seeking Master's Degrees in Business Administration, Management, and Computer Science. Representative courses in the computer science field are: introduction to computer science, computer security, software engineering, and computer architecture. In the business management field, there are courses in organization behavior, competition analysis, and personnel and labor relations.

Facilities

The Center has entered into a leasing agreement with the University of Connecticut at Avery Point. It occupies 10 classrooms, administration offices and space for computer terminals linked to its Hartford computer facility.

Budget

The Center's annual operating budget was approximately $350,000 in 1982-83.

Faculty/Staff

The coursework is handled by a 25-member faculty on an evenings only, four-semester basis.

TABLE A1-1: OVERVIEW OF MARINE RELATED ACTIVITIES AT AVERY POINT

FACILITY	FUNCTION	PERSONNEL	FUNDING SOURCE	FY 83 BUDGET
Marine Sciences Institute	Research	11 researchers,[1] (faculty) and 13 support staff	Funded solely by grants and contracts, 74% govt., 17% industries, 6% Connecticut State agencies, and 3% from non-profit org. and University internal grants	$ 409,000[2]
Department of Marine Sciences	Educational	11 faculty members[1] (4.5 of whom teach in other departments as well)	University of Connecticut	$ 750,000[3]
Marine Advisory Service	Educational and Research	3 professional extension agents, 4 part-time researchers	Two-thirds of its funds received from Connecticut Sea Grant Office, one-third from Connecticut Cooperative Extension Service matching funds and direct State appropriation	$ 212,693[4]
Connecticut Sea Grant Office	Administrator, Coordinator	1 director, 1 assistant	Two-thirds from NOAA and one-third from State matching funds	$ 127,154
Project Oceanology	Educational	1 director, 2 full-time teachers, 1 boat captain, 1 bookkeeper and several summer instructors	Supplied by fees from a consortium of school systems who are provided marine research and instructional facilities.	$ 152,378[5]
U.S. Coast Guard R&D Center	Research, Testing	112 personnel	U.S. Coast Guard	$5,000,000

[1] These eleven researchers/faculty members are the same individuals.

[2] This figure represents external grants and contracts, "soft" funding.

[3] This figure represents University support, "hard" funding.

[4] Two-thirds of this figure represents "soft" funding from Sea Grant, one-third is "hard" University funding.

[5] Fees from member institutions only.

TABLE A1-3: SUMMARY OF U.S. COAST GUARD R&D CENTER ACTIVITIES

Projects are classified by primary scientific discipline and assigned to one of six technical branches for execution.*

CHEMISTRY BRANCH (CHB): Performing applied research on analytical techniques to identify, quantify, detect, and monitor oils and other hazardous polluting substances found in the marine environment. Methods and portable instruments were developed to clarify and positively identify the source of oil spills. The R&D Center has gained national recognition for its contribution in the field of oil fingerprinting using techniques such as gas chromatography, fluorescence spectrophotometry, infrared spectroscopy, and thin-layer chromatography.

ELECTRONICS BRANCH (EIB): Developing specifications and prototype hardware for vessel traffic and control systems for all major U.S. ports to reduce the likelihood of ship strandings and collisions. Collecting, analyzing, and studying traffic patterns in congested waterways. Developing methods to improve and extend the capabilities of navigation systems based on LORAN-C. Providing electronic, instrumentation, and computer support for R&D Center project areas.

PHYSICS BRANCH (PhB): Evaluating the use of alternative energy sources for the 14,000 battery powered aids to navigation presently maintained by the Coast Guard. The research encompasses the evaluation of solar cells, fuel cells, and wind, wave, and current activated power sources. Developing a pollution sensor to aid in detecting oil spills adjacent to fuel docks and petroleum transfer facilities. Studying the optical effects of background lighting on lighted channel markers and buoys. Testing innovations in lamps, fog detectors, and beacons.

MARINE SAFETY BRANCH (MSB): Developing standards of performance for recreational boats and equipment with emphasis on safe loading, flotation, control and fire safety. Utilizing operations research and systems analysis to evaluate various high performance watercraft best suited to meet potential Coast Buard mission requirements. Conducting full-scale fire, explosion, and fire suppresion tests of commercial vessels. Evaluating equipment capable of controlling and separating oily waste discharge from bilges and ballast tanks. Developing methods and equipment for the emergency control, reduction, or prevention of hazardous material discharges from endangered marine vessels.

OCEANOGRAPHY BRANCH (OcB): Conducting applied research to improve the methods for determining the drift of search and rescue objects through predictive techniques based on field measurements of surface current and leeway. Providing methods for the prediction of oil spill spread and movement and analyzing the consequences of potential spills at deep water port sites. Evaluating methods to accurately measure polar ice strength and thickness. Developing a model for predicting the size, frequency and movement of icebergs and for determining their production and deterioration. Improving methods of detecting, tagging, and tracking icebergs.

OCEAN SYSTEM BRANCH (OSB): Investigating buoys, anchors, mooring materials and buoy systems to reduce costs and to improve effectiveness of the navigation aid. Field tests and evaluations are conducted to provide a lightweight anchor and mooring system for Aids to Navigation teams. New designs for buoys to be used in fast flowing water and as emergency buoy replacements are being tested. Evaluating the use of waves as an energy source for powering floating aids to navigation.

*Source: 1981 Annual Report

TABLE A1-4: PHYSICAL PLANT FACILITIES OF THE UNIVERSITY OF CONNECTICUT AT AVERY POINT

BUILDING NO	PAST USE	CURRENT USE	AREA PRESENT
7	Security	Police	8,600
19	Barracks	UCONN Administration	24,467
20	Offices	Plant Maintenance	9,700
21	Mess Hall	Student Center	31,868
22	Classrooms	Academic & Theater	48,743
24	Office, Schools, and Shops	Marine Science	34,715
25	Office & Print Shop	Library	14,564
27	Hospital	Marine Science	14,731
57	Gym	Gym and Pool	32,457
58	Classrooms	Academic Annex	5,500
		TOTAL UCONN	225,345 sq.ft.
23		U.S. Coast Guard	64,700
26		Branford Convention Center	18,900
29		Project Oceanology	4,975
		TOTAL OTHER	88,575 sq.ft.

TABLE A1-5: MARINE SCIENCES INSTITUTE RESEARCH GRANTS AND CONTRACTS 1/1/78 - 2/15/83 BY SOURCE OF FUNDING

SOURCE	NO. PROJECTS	TOTAL FUNDING
Department of Environmental Protection (Coastal Area Management), State of CT	1	$ 55,000
Department of Environmental Protection, State of CT	4	65,500
Environmental Protection Agency (US)	1	154,000
Hayden, Harding & Buchanan	1	54,426
International Paper	1	45,000
Institute of Water Resources	4	29,057
National Oceanic and Atmospheric Administration	2	36,088
Nuclear Regulatory Commission	5	69,669
National Science Foundation	7	485,131
Naval Underwater Systems Center	16	1,071,793
Oceanic Society	1	18,930
Office of Naval Research	1	58,000
Office of Policy and Management, State of Connecticut	1	36,347
Science Applications, Inc.	10	358,419
Sea Grant	1	56,000
University Research Foundation	5	34,870
	61	$2,628,230

TABLE A1-6: MARINE SCIENCES INSTITUTE ACTIVE RESEARCH GRANTS & CONTRACTS - APRIL 21, 1983

INVESTIGATOR	SOURCE	TITLE	AMOUNT	GRANT PERIOD
W. F. Bohlen	DEP/CAM	An Investigation of Connecticut Shoreline Dynamics	$ 55,000	10/1/81 - 6/1/83
	SAI	Sediment Transport	45,484	8/1/82 - 9/30/83
	SAI	Studies of Dredge Induced Resuspension - Boston Harbor	12,000	2/1/83 - 7/31/83
W. F. Fitzgerald	NSF	Sea-Air Exchange Project (SEAREX) - Air-Sea Exchange of Mercury	102,179	10/1/81 - 3/31/84
S. Y. Feng	SAI	Analysis of Trace Metals in Mytilus edulis	123,117	11/2/81 - 9/30/83
	SAI	Operation of R/V UCONN	20,700	3/23/83 - Indef.
J. D. Buck and S. Y. Feng	HHB	Environmental Studies: Fort Hill Brook and Mumford Cove, Connecticut	54,426	7/13/81 - 5/30/83
L. Stewart	SAI	Visual Observations	52,117	10/2/81 - 9/30/83
D. G. Waslenchuk	NSF	The Geochemistries of the Metalloids Arsenic, Antimony, Bismuth, Germanium & Selenium in U.S. Rivers	116,498	2/1/81 - 1/31/84
	OC	Hydrocarbon Burdens in Sediments and Benthic Organisms	18,930	10/27/81- 10/26/83
B. L. Welsh	OPM	Effects of Energy Related Transport Activities on Benthic Marine Plants, Fish, Shellfish and Lobsters in the Thames River Area	36,347	10/7/82 - 9/30/83
B. Whitlatch	NSF	Marine Benthic Community Structure: Small Scale Patterns in Spionids	36,714	11/1/80 - 10/1/83
	NSF	In Situ Experiments on Animal-Sediment Relationships in the Deep Sea	61,774	12/1/81 - 5/31/84
	SG	Life History and Resource Management of the Hard Shell Clam Mercenaria mercenaria	56,000	7/1/82 - 6/30/83

DEP/CAM Connecticut Department of Environmental Protection, Coastal Area Management
SAI Science Applications, Inc.
NSF National Science Foundation
HHB Hayden, Harding and Buchanan, Inc., Consulting Engineers
OC Oceanic Society
SG Sea Grant
OPM Connecticut Office of Policy and Management

TABLE A1-7: HIGHLIGHTS IN DEVELOPMENT OF MARINE SCIENCES INSTITUTE AND THE MARINE BIOLOGICAL LAB

1957 • Marine Biological Lab (MBL) opened in Noank; originally a summer station for University of Connecticut faculty research studies on marine vertebrates and marine algae in Long Island Sound.

1963 • MBL got its first resident faculty member, a marine ichthyologist.

1966 • Three resident faculty members established at MBL; marine microbiologist, marine geologist, marine shellfish specialist.

1967 • State of Connecticut reacquired Avery Point following move of U.S. Coast Guard training center to Governor's Island, NY. Avery Point was state-owned, but was taken over during WWII by the Federal government for the Coast Guard. Therefore, when Coast Guard left (they still maintain a R&D Center there), the deed reverted to Connecticut.

1967 • The southeastern branch of the University of Connecticut, and the Marine
1968 Sciences Institute established at Avery Point. Dr. Peter Dehlinger (a geophysicist) appointed first director of the Institute. Dr. Dehlinger added University of Connecticut faculty staff members to MSI for physical, geological, chemical, and geophysical studies of marine biology.

1970 • The MBL and MSI merged.

1979 • Marine Sciences Department was established within the MSI.

1982 • Eleven faculty members teach undergraduates and graduate students and conduct research; Dr. Sung Y. Feng is Director of MSI. There are approximately 13 supporting staff members including: secretaries, administrative assistant, typists, machine and electronic shop technicians, and crew for vessels.

TABLE A1-8: CONNECTICUT SEA GRANT PROGRAM BUDGET, 1982-83

SEA GRANT PROGRAM	TOTAL	FEDERAL SEA GRANT	STATE MATCHING FUNDS
Research Projects			
School of Business Administration			
Management and marketing of Long Island Sound Oyster	$ 64,472	$ 41,603	$ 22,869
Marine Sciences Institute			
Resource Management of the hard clam	73,395	56,298	17,097
Sub-total (research)	137,867	97,901	39,966
Advisory Services			
Marine Advisory Service	212,693	119,952	92,741
Program Management			
Sea Grant Office (administration and coordination)	127,154	32,147	95,007
TOTAL	$447,714	$250,000	$227,714

TABLE A1-9: CONNECTICUT MARINE ADVISORY SERVICE BUDGETS

YEAR - BEGINNING JULY 1	SEA GRANT FEDERAL GRANT	STATE MATCHING FUNDS
1979 - 80	$ 93,900	$47,300
1980 - 81	109,545	54,500
1981 - 82	115,000	89,000
1982 - 83	119,952	92,741
1983 - 84 preliminary	172,280	92,716

TABLE A1-10: CONNECTICUT SEA GRANT COHERENT PROJECT PRELIMINARY PROPOSAL BUDGET FOR 1983-84 (FEBRUARY 1, 1983 SUBMISSION)[1]

	NOAA Grant Funds	State Matching Funds
RESEARCH		
MARINE RESOURCES DEVELOPMENT		
Aquaculture	$ 67,159	$ 31,637
Living Resources	152,865	64,878
SOCIO-ECONOMIC AND LEGAL STUDIES		
Economics and Coastal Law	57,866	24,344
MARINE TECHNOLOGY RESEARCH AND DEVELOPMENT		
Ocean Engineering	32,372	32,258
MARINE ENVIRONMENTAL RESEARCH		
Environmental Contaminants	24,601	7,595
Total Research	$334,863	$161,712
EDUCATION		
MARINE EDUCATION AND TRAINING		
Other Education	2,500	8,400
ADVISORY SERVICES		
ADVISORY SERVICES		
Extension Programs	172,280	92,716
Other Advisory Services	35,530	18,103
Total Advisory Services	$207,810	$110,819
PROGRAM MANAGEMENT AND DEVELOPMENT		
PROGRAM MANAGEMENT		
Planning, Administration and Development	58,431	113,962
TOTAL	$603,613	$394,893

Note: In May NOAA notified Connecticut that it could expect a Sea Grant award of no more than $350,000 in NOAA Sea Grant funds. A revised 1983-84 program and budget is being submitted to NOAA. Four research projects and one advisory service project are being deferred or reduced in scale. The revised budget will also modify the amount of State matching funds.

[1] Source: Connecticut Sea Grant Coherent Project Proposal. Vol. 1, p. viii. February 1, 1983 Submission. Connecticut Sea Grant Office.

TABLE A1-11

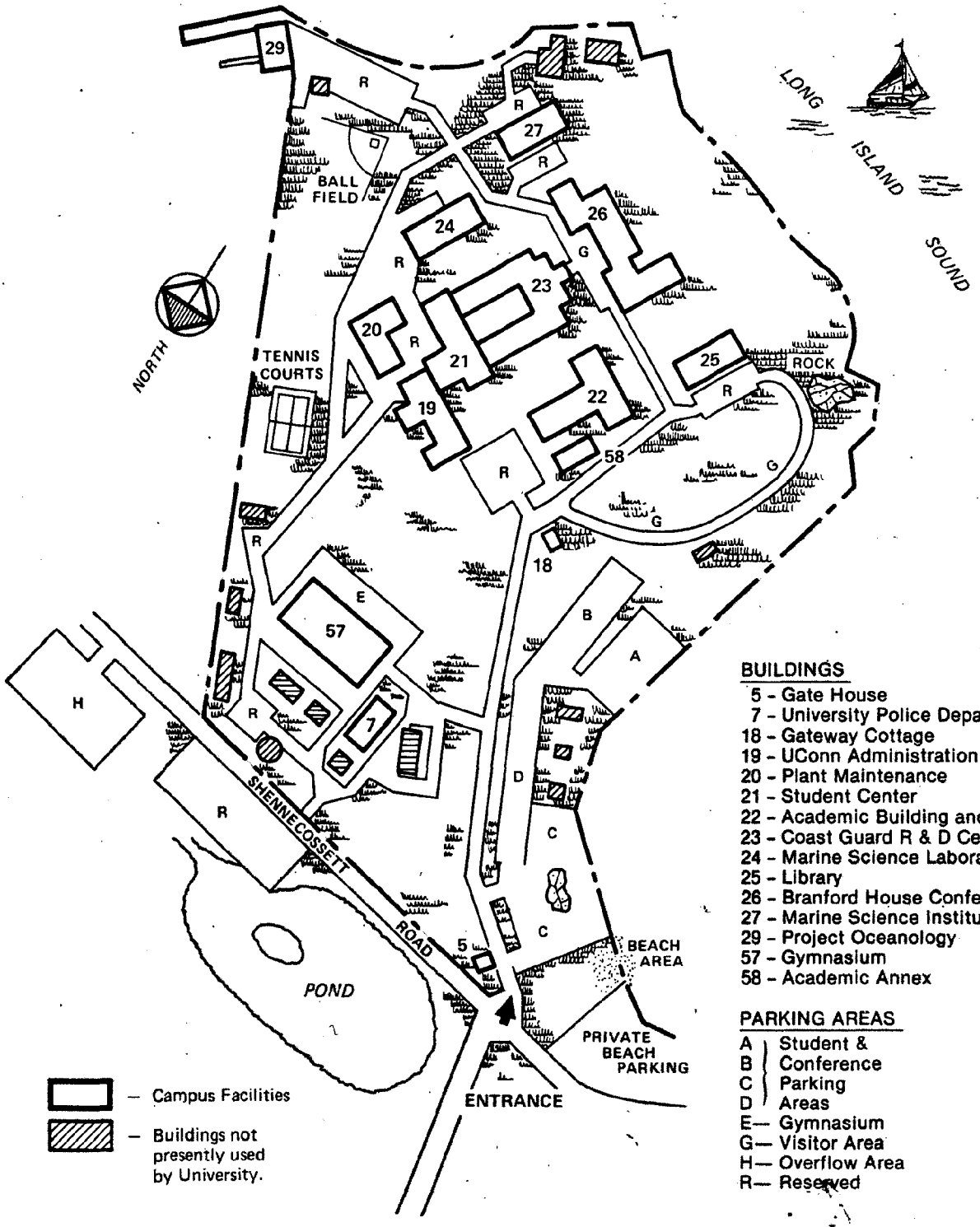
D.A. Memo #83-08
December 14, 1982

PROJECT OCEANOLOGY PROPOSED FY-84 (1983-84) MEMBERSHIP FEE SCHEDULE

ADOPTED BY DELEGATE ASSEMBLY

	YOU GET								YOU PAY	
			Number of 2 1/2 hour Programs					Number of Students in		
Div. I. Schools	Enrollment Gr. 7-12 Oct. 82	% Involvement	Enviro-lab Programs (@10)	Shore-lab Programs (@7)	In-School Programs (@4)	After School Programs (@5)	Summer Programs (@15)	Instructional Units	FY-83 (1982-83) Fee	FY-84 (1983-84) Fee
Montville Corr. Ctr.	20	1.86	4	1	11	0	0	91	2,535	2,770
Franklin	43	1.86	4	1	1	2	2	91	2,535	2,770
Bozrah	77	1.86	4	1	1	2	2	91	2,535	2,770
Salem	88	1.86	4	1	1	2	2	91	2,535	2,770
Williams	211	1.86	4	1	1	2	2	91	2,535	2,770
North Stonington	400	2.25	5	1	1	2	2	101	3,080	3,350
Griswold	618	3.47	8	2	2	2	3	157	4,132	5,167
Norwich Tech	644	3.62	9	2	1	2	3	163	4,657	5,391
Grasso-SE Tech	742	4.17	10	3	1	3	3	185	5,491	6,210
Norwich	902	5.07	12	3	2	3	4	224	6,779	7,550
Stonington	1,286	7.23	17	4	2	5	6	321	9,703	10,766
Montville	1,461	8.21	20	5	2	6	7	378	10,842	12,226
Waterford	1,490	8.37	20	5	2	6	7	378	11,625	12,464
New London	1,517	8.52	21	5	2	6	7	388	11,788	12,687
Ledyard	1,647	9.25	22	6	2	7	8	425	12,933	13,774
East Lyme	1,670	9.38	23	6	2	7	8	435	12,783	13,968
Groton	2,533	14.23	35	9	4	10	12	659	20,090	21,190
Act. #3 or Replacement School		6.93	18	4	3	5	6	335	9,700	10,320
DIV. I. SUBTOTAL	15,349	100.00	240	60	41	72	84	4,604	136,278	148,913
Div. II Schools										
Mystic Aquarium		2.09	10	9	-	-	-	96	2,850	3,112
Mohegan Community College		1.86	9	9	-	-	-	91	2,535	2,770
University of Connecticut		5.49	21	21	-	-	-	253	8,180	8,180
E C S C		1.86	9	9	-	-	-	91	2,535	2,770
DIV. II. SUBTOTAL		11.30	49	48				531	16,100	16,832
TOTAL		111.30						5,135	$152,378	$165,745

THE UNIVERSITY OF CONNECTICUT AT AVERY POINT



— Campus Facilities

— Buildings not presently used by University.

BUILDINGS

5 - Gate House
7 - University Police Department
18 - Gateway Cottage
19 - UConn Administration Building
20 - Plant Maintenance
21 - Student Center
22 - Academic Building and Theatre
23 - Coast Guard R & D Center
24 - Marine Science Laboratory
25 - Library
26 - Branford House Conference Center
27 - Marine Science Institute
29 - Project Oceanology
57 - Gymnasium
58 - Academic Annex

PARKING AREAS

A, B, C, D — Student & Conference Parking Areas
E — Gymnasium
G — Visitor Area
H — Overflow Area
R — Reserved

APPENDIX 2

APPENDIX 2: FUNDING OF UNIVERSITY-LINKED MARINE CENTERS

A. SPECTRUM OF MAJOR MARINE SCIENCE CENTERS

Academic marine science activity in the United States takes place in institutions of varying size, focus, and affiliation. The largest center is Scripps Institution of Oceanography (Scripps) in California, with a staff of 1,100 and a budget of approximately $62 million. The next largest center is Woods Hole Oceanographic Institute (WHOI) in Massachusetts with a staff of over 800 and an annual budget of approximately $38 million. These two centers are by far the largest in the U.S., with broad national and international programs.

A spectrum of U.S. marine centers is reflected in the membership of UNOLS, the University-National Oceanographic Laboratory System.[1] The 17 full members of UNOLS are "major laboratories in the United States which operate ...our nation's academic research fleet."[2] These institutions have significant seagoing oceanographic facilities:

°University of Hawaii
University of Alaska
°University of Washington
°Oregon State University
University of Southern California
°University of California, Scripps
University of Michigan
°Texas A&M University
°University of Texas
°University of Miami
Skidaway
Duke University
Johns Hopkins University
University of Delaware
°Lamont-Doherty Geological Observatory
°University of Rhode Island
°Woods Hole Oceanographic Institution

Of the 17 full members of UNOLS, ten (°) are also members of the Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES), and are among the largest marine science institutions in the U.S.

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[1] UNOLS is a joint effort by the academic community and oceangraphic research facilities to coordinate utilization and planning for these oceanographic facilities.

[2] 1982 Tentative Research Vessel Operating Schedule, compiled May 1981, UNOLS Office, Woods Hole Oceanographic Institution, Massachusetts.

Another 31 institutions are associate members of UNOLS. The University of Connecticut, which operates the existing marine science center at Avery Point, is among these members. The other associate members are:

University of Alabama
Bermuda Biological Station
Bigelow Laboratory for Ocean Sciences
Brookhaven National Laboratory
University of California, Santa Barbara
Cape Fear Technical Institution
Florida Institute for Oceanography
Florida Institute of Technology
Florida State University
Harbor Branch Foundation
Hobart & William Smith Colleges
Lehigh University
University of Maine
Marine Science Consortium
University of Maryland
Massachusetts Institute of Technology
Moss Landing Marine Laboratory
University of New Hampshire
New York Ocean Science Laboratory
SUNY at Buffalo
SUNY at Stony Brook
University of North Carolina
Nova University
Occidental College
University of Puerto Rico
San Diego State University
Virginia Institute of Marine Sciences
Walla Walla College
University of Wisconsin at Madison
University of Wisconsin at Milwaukee

What Constitutes a "Major" Center?

At what point does the mix of professors, graduate students, facilities, and supporting funding reach the "critical mass" that entitles a marine science center to be considered "major"? Should a major center be one that is prominent within its State, within its region, within the nation? Should prominence be measured by the quality of the faculty, by the number of faculty members or graduate students, by the number of advanced degrees granted, by the size of the program budget? No precise standard is possible, but some definition is necessary in order to explore further the feasibility of establishing a comparable "major" center at Avery Point.

To aid in considering possible criteria for the definition of a "major" center, Table A2-1 shows comparative information on a number of existing centers. Two of these centers, frequently mentioned by persons interviewed about possible major expansion of the existing center at Avery Point, are the Graduate School of Oceanography of the University of Rhode Island (URI) and the Marine Sciences Research Center of the State University of New York at Stony Brook (SUNY). With a faculty of 39 and a total budget of approximately $14 million, URI seems to be generally accepted as a major institution. SUNY has a faculty of 23 with a total budget of around $3 million. SUNY, in contrast to URI, and the other unmistakably major centers such as Scripps and WHOI, has chosen to focus on the coastal marine environment. Although SUNY is widely recognized for its coastal orientation, it is not generally considered "major" in the national overall oceanographic perspective.

As suggested in the report, a major center would require two kinds of operating funds: grants and contracts ("soft" funding) plus basic institutional support ("hard" funding). At the very large centers such as Scripps and WHOI, "hard" funding represents roughly 20 to 25 percent of the total budget; the remainder is provided by grants and contracts. For example, approximately 81 percent ($50 million) of Scripps 1982 budget of nearly $62 million[1] came from non-state or university funds. Woods Hole received approximately $33 million in "soft" funds accounting for about 85 percent of its total budget. At Lamont-Doherty Geological Observatory (L-DGO), "soft" funds accounted for 73 percent of the budget.

At the largest centers, researchers are able to generate this vast amount of external funding. Smaller academic institutions, it appears, do not have such a high ratio of "soft" to "hard" funding; the smaller centers generally rely much more heavily on "hard" funds. SUNY at Stony Brook had 68 percent "soft" funds in 1982, and the University of Delaware 62 percent. For the four marine elements of UCONN at Avery Point, as shown by the following figures for FY 83, the "soft"funding figure was 37 percent:

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[1]The Scripps total budget for FY 82 includes $22,234,000 in grant funds for the Deep Sea Drilling Project.

	Hard[1] (University)	Soft[1] (External)	Total
Marine Sciences Department	$750,000[2]	-	$ 750,000
Marine Sciences Institute	-	$409,000[3]	409,000
Marine Advisory Service	92,741	119,952	212,693
Sea Grant Program Office	95,007	32,147	127,154
TOTALS	$937,748	$561,099	$1,498,847

Recognizing that no precise definition is possible but that some approximation is essential, we have adopted a budget criterion: any new "major" center would have to have an annual budget of at least $6 million. This figure, substantially larger than SUNY's but far smaller than the present budget of URI, may be too small; a threshold of $8 million or even $10 million has been suggested. Obviously, if the $6 million threshold is too low, the funding needs analyzed in the following sections should be increased accordingly.

B. SOURCES, ALLOCATIONS AND TRENDS IN OCEANOGRAPHIC FUNDING

1. Federal Oceanographic Funding

Sources. Major Federal financial support for oceanographic research has traditionally come from the National Science Foundation (NSF)[4]; the Department of the Navy, in particular the Office of Naval Research (ONR); and the National Oceanic and Atmospheric Administration (NOAA). (See Table A2-2.) NSF is the single largest supporter of Federal oceanographic research, supplying over $96 million in FY 81, about 37 percent of the total Federal obligation. ONR awarded approximately $34 million to academic institutions for oceanography in FY 81, or

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[1] Figures in these columns include indirect costs as well as direct costs.

[2] Figure includes indirect costs estimated by RMFA at 25 percent of staff salaries and fringe benefits. The actual rate of indirect costs was unavailable.

[3] Excluded from this table is one research project partially supported by Federal Sea Grant funds which was conducted at UCONN's School of Business Administration by the Principal Investigator Professor M. Hurrmire on the Storrs Campus. Since Professor Huffmire is not a member of the Marine Sciences Institute, this project was excluded in the budget figure for MSI external funds. The project received a Federal Sea Grant award of $41,603, and University matching funds of $22,869. The research topic was the resource management of Long Island Sound oysters.

[4] Although not a Federal agency, NSF is considered as Federal funding source because it receives its funds by Congressional appropriation.

13 percent of the Federal total. NOAA's contribution for oceanographic research amounted to $59.2 million, 23 percent of Federal obligations, for FY 81.

b. Allocation. Large, well-established marine centers received more than 89 percent of the total Federal funds available to academic institutions from NSF, ONR, and the NURP unit of NOAA in FY 82. Table A2-3 shows those academic institutions receiving the largest amount of these Federal oceanographic research dollars. Of NSF's FY 82 total oceanographic research budget of $97.3 million, about $95 million (97 percent) went to ten academic institutions.

Similarly, ONR granted the major portion of its FY 82 budget to a few large institutions. About 70 percent of ONR's oceanographic awards to academic institutions went to 10 institutions.

The three institutions receiving the largest share of funds from both NSF and ONR were Scripps Institution of Oceanography, Woods Hole Oceanographic Institution, and Lamont-Doherty Geological Observatory.

NOAA's National Undersea Research Program, with an FY 82 budget of $2.9 million available to academic institutions for oceanography, allocated approximately 91 percent of this budget to five institutions.

The allocation of NOAA Sea Grant Program funds to specific institutions is difficult to determine. Although one institution may have the responsibility for administering Sea Grant funds within a state, these funds may be allocated to other institutions. The final destination of Sea Grant dollars to a particular institution, therefore, is unavailable at this time. However, Table A2-3 does show the allocation of the majority of Sea Grant funds to those institutions administering the funds. Table A2-4 and A2-5 illustrate a more detailed Sea Grant Program breakdown by institution and by state.

A third NOAA administered program, Saltonstall-Kennedy, also funds academic institutions. S-K projects in the Northeast[1] is shown in Table A2-6.

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[1] U.S. Census' definition of Northeast.

NOAA in-house operation of oceanographic facilities in the Northeast is presented in Table A2-7.

c. Trends. The decade of the 1970's was a period of active Federal participation in marine science programs and funding. With the enactment of the Marine Resources Act and the establishment of the Sea Grant Program in the late 1960's, Federal support for ocean sciences was on the upswing. The 1970's witnessed expanded Federal involvement especially through designation of the International Decade of Ocean Exploration (IDOE). The Federal allocation for IDOE funding accounted for 11 to 16 percent of the total Federal oceanographic research expenditure, or about $14 to $20 million annually during the decade.[1] In addition, other Federal programs were initiated, such as Coastal Zone Management and Saltonstall-Kennedy.

In recent years, Federal funding for oceanographic research has not been as favorable. (See Table A2-8.)

The total NSF oceanographic budget, including the Deep Sea Drilling Project (DSDP) increased 2.4 percent from the FY 81 budget of approximately $95.0 million to the FY 82 budget of $97.3 million. This budget also increased in FY 83 by 5.1 percent to $102.2 million. Both of these increases, however, have been below the national annual rate of inflation.[2]

The annual budgets for the Office of Naval Research have fluctuated greatly in the 1980's for oceanographic research awards to academic institutions. In FY 80, this ONR budget peaked at approximately $52.4 million, then plunged to $34.4 million in FY 81, increased to $42.8 million in FY 82 and is estimated at $44 million in FY 83.[3] Even with the FY 82 and FY 83 increases, the $44 million figure is still 16 percent below the FY 80 level.

NOAA's Sea Grant Program experienced a 19 percent decrease from FY 81 to FY 82. Since 1982, it has been operating under a Congressional continuing resolution. The future of the program is conjectural, with

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[1] National Academy of Sciences, The Continuing Quest, 1979, pages 9-10.

[2] U.S. Department of Labor.

[3] Estimate of Gordon Hamilton, Associate Director for the ONR Environmental Sciences Directorate, June 27, 1983.

the Administration requesting program elimination. No decision has yet been reached on the Sea Grant Program for FY 84.

Two other NOAA programs -- NURP and Saltonstall-Kennedy -- are also slated by the Administration for elimination. The NURP budget available to academic institutions, $2.9 million in FY 82, is estimated at $2.5 million for FY 83[1], a 14 percent decline.

The Saltonstall-Kennedy program derives its budget from an import tariff. The total of the S-K budget available for oceanographic research and development projects has been decreasing. From FY 80 to FY 81 this budget dropped from $12.2 million to $8.8 million. The budget decreased further, to $8.2 million, in FY 82.

As a result of the current tightening of the Federal oceanographic budget, competition among established institutions for available funds has become particularly fierce. As Senator Pell of Rhode Island said (several years ago):

> "We are faced with more lean budget years for all federal programs. Oceanographic programs will have to prove they are necessary and important to hold their own in the competition for federal dollars."[2]

In our interviews with representatives of marine centers, many expressed the opinion that Federal dollars should be allocated to the established marine science centers and that no start-up funding for other centers should be provided until the overall funding picture brightens.

2. University of Connecticut (UCONN) Funding

a. Sources. UCONN receives the majority of its operating funds from three sources: The State General Fund, the Tuition Fund, and external grants and contracts for research services. The operating budget of the University for FY 82 was about $165 million.[3] The State General Fund and the Tuition Fund are the principal sources of revenue for instructional and support programs.

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[1]The FY 83 NURP budget was estimated by Dr. Elliott Finkle, Director of the National Undersea Research Program, as of June 24, 1983.

[2]University of Rhode Island, Marine Programs at the University of Rhode Island. n.d. page 6.

[3]This figure does not include the Health Center budget.

Through a complicated process of review and evaluation by the Board of Higher Education (BHE) and the Board of Governors (BOG), the State General Funds are awarded by the Connecticut Legislature. UCONN's determination of priorities and associated budget requests are forwarded to the BHE and then to the BOG. The BOG formulates a University budget and submits it to the Governor. The Governor then presents his UCONN budget to the Legislature. The BHE negotiates with a subcommittee of the Appropriations Committion for a University budget. The recommendations of the subcommittee are generally passed, relatively unchanged, by the Legislature. The Legislature's program allocations do not, however, have to be followed by the University. UCONN allocates the dollars received from the Legislature according to its final priorities which may be different from those stated in the budget justification.

In 1980, the University's budget procedure was greatly improved. UCONN was granted the authority by the State Legislature to collect and disperse its own tuition. This Tuition Fund is currently approximately $11 million.

Grants and contracts received from non-university sources (external), are the primary source of research funding. External grants and contracts are solicited and utilized by University departments and individual professors for research services. A portion of all external grants and contracts is recovered by the University to defray indirect costs.

b. Allocation. The past decade has been a period of austerity for University funds obtained from the State. In view of tight budgets, the University has established priority areas for programs and spending.

In planning for its future program and funding priorities, the University has drafted a plan entitled "Opportunities for the '80's."[1] This draft planning document is designed to "... chart a course for the University regardless of the financial resources available." The

[1]Office of the Vice President for Academic Affairs, UCONN, Draft, Opportunities For the 80's, April 6, 1983.

plan identifies "Programs of Excellence" that deserve special recognition and support. The plan recommended that these designated programs "...be granted stable General Fund and Tuition budgets over the next three years and priority for new resources".

The University has not, so far, designated any marine units to be a "Program of Excellence." However, the report on the Marine Sciences Institute will be made at a future date. Concerning the Avery Point campus itself, the draft plan recommends that , "the graduate programs in marine sciences and the research and extension service activities of the Sea Grant Program, should have the highest priority for growth and development ..." However, the future of the graduate program is recognized as being heavily dependent on the continued support of the Federal Sea Grant Program and other external sources of funding. No mention of UCONN funding support is made in this context.

In exploring the allocation of University funds to marine sciences, a 1980 Board of Higher Education (BHE) report[1] is of critical importance. The report investigated the feasibility of expanded marine sciences activities in Connecticut, and arrived at the following recommendations:

"1. Due to the extent and importance of the state's marine environment, the state's commitment to the marine sciences should be increased and made more explicit.

2. Interaction and coordination among appropriate public and independent institutions of higher education and state and federal agencies should be improved.

   a) A marine sciences clearinghouse should be developed at Avery Point to serve as a source of statewide information on marine science needs, activities and resources.

   b) The Board of Higher Education will establish an advisory committee on the marine sciences. The nucleus of this committee will be the study group formed to assist the Board's staff in this report. Membership will be expanded to include representatives from the State Department of Agriculture and Natural Resources (Division of Aquaculture), the Department of Economic Development, and related business and industrial firms. Interested independent institutions of higher education will be represented. This

[1] Connecticut Board of Higher Education, A Study of the Feasibility of Establishing a Maritime Academy and Expanding Marine Science Activities in Connecticut, 1980. pages 13-14.

committee will oversee the transition from the current largely independent marine sciences activities to a more coordinated statewide effort.

3. The state should increase the level of financial support for the marine sciences, while other sources of funding, particularly federal, continue to be pursued. Additional state support can come from the reallocation of existing resources at the University of Connecticut and the State College and/or supplemental appropriations.

   a) The Board of Higher Education, in order to continue to offer informed recommendations in the area of marine sciences, will ask the advisory committee on marine sciences (recommendation 2b) to advise it on 1) the sequencing of actions needed in order to expand the state's marine sciences activities in education, research and public service; and 2) the availability of non-state funds and additional state support needed to implement those actions.

   b) The University of Connecticut should expeditiously pursue the development and submission of a "Coherent Program" proposal for funding under the National Sea Grant Program in cooperation with other eligible parties."

The University of Connecticut responded to some of these recommendations:

- o The responsibility for the statewide clearinghouse for marine information was assigned to the Sea Grant Program Office at Avery Point.
- o Federal funds were more actively sought and "Coherent Project" status was obtained in the Sea Grant Program.
- o Additional State funding was obtained for marine sciences as a match for Sea Grant funds only.

The University has so far failed, however, to designate marine sciences as a priority area for funding and new resources. As such, no new faculty positions have been added and there has been no substantial facilities improvements made. (One non-faculty staff position has been added.) The University did not reallocate existing resources in favor of marine sciences. Also, the BHE has not yet established an advisory committee on marine sciences.

c. Trends. Although the University of Connecticut's overall operating budget has grown steadily, it has not kept pact with program expansion, the deterioration of the physical plant, and the high percentage of

personnel and energy costs.[1] In assessing the future financial resource base available to the University, the draft plan for the 80's assumes that the three principal fundings sources "--the General and Tuition Funds, and external grants and contracts -- will at best keep up with inflation and will tend to become less flexible."[2] Concerning the external grants and contracts that pass through the Research Foundation, the major trends and assumptions are:

> "Federal support for basic research at UCONN in the physical, biological, and applied sciences and engineering will be maintained for the next 3-5 years, but there will continue to be cutbacks in federal support in other basic research areas.
>
> We will have a modest increase in corporate support during the next 3-5 years, but corporations will not be willing to pay the full rate of indirect cost at the University.
>
> Indirect cost recovery will at best keep pace with inflation, but may very well decline relative to inflation."[3]

C. START-UP FUNDING FOR AN EXPANDING AVERY POINT CENTER

In addition to operating funds, substantial "start-up" funds would be needed for major expansion of the Avery Point center. Those funds would be needed for two broad purposes: first, to provide a basis for attracting and sustaining the critical mass of faculty and graduate students during the period (approximately 5 years) before outside grants produce the requisite "soft" funding. Second, to provide the physical facilities (laboratories, instrumentation and harbor improvements) necessary to support the educational and research activities of that faculty and student population.

Although the amount of needed "start-up" funding for a major expansion at Avery Point is difficult to estimate accurately, we are estimating that funding of at least $5 to $7 million would be needed. This would be a one-time cost (spread over approximately five years) to the University for capital improvements and for the initial salaries of new principal investigators of national stature and their technical and support staff:

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[1] Opportunities For The 80's, Draft, The University of Connecticut, Office of the Vice President for Academic Affairs, April 6, 1983, page 5.

[2] Ibid, page 7.

[3] Ibid, page 8.

Capital Costs

Laboratories		$1.0 to $3.0 million
Docks and Harbor Improvements		1.0 million
Dormitories (50 occupants)		.5 million
	Total	$2.5 to $4.5 million

Staff Salaries for 5 years

5 principal investigators/year, with technical and support staff, at $100,000/year.		$2.5 million
	TOTAL	$5.0 to $7.0 million

TABLE A2-1: MATRIX OF MARINE INSTITUTIONS*[1]

Institution	Oceanographic Area of Specialization	On-site Federal Link	Nearby[2] Marine-related Federal Facility	UNOLS Membership	Major Vessels	Graduate Enrollment/ Oceanography Degree Awards	Number of Faculty	Total Staff	Percent Hard/Soft Funding	Total Marine Budget (Millions)
Scripps	All	NMFS	Naval Base NOSC	Full	245' 209' 170' 95' 2 platforms	190/45	85	1,100	19/81	62
WHOI	All	USGS NMFS	-	Full	244' 210' 177' 98'/ALVIN[3]	100/9 Ph.D.	Jointly with MIT	800	15/85	38
L-DGO	All	-	-	Full	208'	100/10 Ph.D.	120[5]	600	27/73[6]	16.8
URI	All	EPA NMFS/AEG SG Dep.	Naval Base NUSC	Full	177'	147/11 MS 15 Ph.D.	39	344	20/80	14
VIMS	Estuarine/ Coastal	-	NASA LRC	Associate	85'	137/10 MA 3 Ph.D.	59	220	23/77	9
U. Delaware	All	-	-	Full	120'	73/29 MS 13 Ph.D.	14 "core" 33 Joint Appt's.	200	38/62	4.5
U. Maine[4]	Estuarine/ Coastal	-	-	Associate	-	50/15	25	100	31/69	3.2
SUNY	Estuarine/ Coastal	-	Brookhaven National Laboratory	Associate	55'	109/21 MS 4 Ph.D.	23	100	32/68	3
UCONN	Estuarine/ Coastal	CG R&D	Submarine Base NSMRL NUSC CG Academy	Associate	65'	29/5 MS 2 Ph.D.	11	24	63/37	1.5

*See following page for footnotes and source information.

[1]All figures are one-year estimated totals from the best available data for FY 82 except as otherwise indicated below. Staff, faculty, and financial totals do not inclue on-site or nearby Federal facility totals.

[2]Nearby: located within the same town limits or within approximately 20 miles.

[3]98'/ALVIN: The ALVIN is a national facility located at Woods Hole. The 98' LULU is the ALVIN's support vessel.

[4]The University of Maine has no separate marine science academic department. Estimates for marine graduate enrollment, degree awards, and overall staff were made by University of Maine marine personnel.

[5]Total for Academic and Research staff, no total available for faculty alone.

[6]The "soft" money figure includes only funds from governmental sources. Contributions from private industry and other non-governmental sources are included in "hard" funding. No further breakdown could be obtained.

ABBREVIATIONS

Scripps - Scripps Institution of Oceanography U. of California, San Diego
WHOI - Woods Hole Oceanographic Institution
L-DGO - Lamont-Doherty Geological Observatory Columbia University
URI - University of Rhode Island (Graduate School of Oceanography)
VIMS - Virginia Institute of Marine Sciences, College of William and Mary
U. Delaware - College of Marine Studies, University of Delaware
SUNY - Marine Sciences Research Center State University of New York, Stony Brook
NMFS - National Marine Fisheries Service
AEG - Atlantic Environmental Group (NMFS)
USGS - United States Geological Survey
EPA - Environmental Protection Agency
SG Dep - Sea Grant Depository
CG R&D - Coast Guard Research & Development Center
NOSC - Naval Ocean Systems Center
NUSC - Naval Underwater Systems Center
LRC - Langley Research Center (NASA)
NSMRL - Naval Submarine Medical Research Lab.
CG Academy - Coast Guard Academy

RAW DATA ON MARINE INSTITUTIONS WAS OBTAINED FROM THE FOLLOWING SOURCES

Scripps - Communication with Ms. J. Hammons, Public Affairs; University of California, San Diego, Scripps Institution of Oceanography 1982, vol. 16, number 1 (January 1983).

WHOI - Communication with Ms. N. Green, Public Affairs; and Annual Report, 1981. 1982.

L-DGO - Communications with Ms. R. M. Cline, Administrator of Oceans & Climate Division, Ms. J. Shampeau, Administrator of Marine Geology and Geophysics Division; Columbia University, Lamont-Doherty Geological Observatory, Yearbook 1981-82. Vol. 3, 1983; National Science Foundation, Division of Ocean Sciences, "Sources of Oceanography Support for 17 Major UNOLS Institutions FY 1981 and 1982".

URI - Communication with Dr. R. Sexton, Assistant to the Dean of the Graduate School of Oceanography; University of Rhode Island, Annual Report - Graduate School of Oceanography and Provost for Marine Affairs. July 1, 1981 - June 30, 1982.

VIMS - Communications with Dr. Zeigler, Associate Director of VIMS and Associate Dean of the School of Marine Science, Mr. B. Brummer, Assistant Comptroller of VIMS; College of William & Mary, Virginia Institute of Marine Science, School of Marine Science. Forty-first Annual Report for the Period Ending 30 June, 1982. 1983.

U. Delaware - Communications with Mr. Schneider, Executive Officer, Dorothy Woods, Academic Affairs Administrator (graduate enrollment); University of Delaware, College of Marine Studies, Marine Programs, 1982. June 1982.

U. Maine - Communication with Dr. R. Dearborn, Executive Director of Sea Grant.

SUNY - Communications with Ms. J. Schoof, Assistant to the Director of MSRC and Public Affairs Officer; State University of New York at Stony Brook, Marine Sciences Research Center, Annual Report, 1980-82. July 15, 1982.

UCONN - Communications with Dr. J. Baird, Director, Avery Point Campus; Dr. J. Elias, Dean, College of Liberal Arts and Sciences; Dr. S. Feng, Director, Marine Sciences Institute, and Acting Director of Marine Sciences Department; Dr. V. Scottron, Director, Connecticut Sea Grant Office; Dr. L. Stewart, Program Leader, Marine Advisory Service; University of Connecticut documents: Marine Sciences Institute, 1981-82 Annual Report. June 15, 1982. Marine Sciences Institute, "Active Research Grants and Contracts". April 21, 1983. Marine Sciences Department and Institute, "Office Memoranda: Planning Process, Phase II." March 11, 1983. Revised Sea Grant Coherent Project Proposal, 1982-83. Vol. 1.

University - National Oceanographic Laboratory System, Woods Hole, MA. 1982 Tentative Research Vessel Operating Schedule. May 1981.

TABLE A2-2: FEDERAL OBLIGATIONS FOR RESEARCH IN OCEANOGRAPHY IN FISCAL YEAR 1981[1] (thousands of dollars)

FEDERAL SOURCE	
Department of Commerce, total	$ 69,191
ERTA	10,001
NOAA	59,190
Department of Defense, total	58,332
Department of the Army	436
Department of the Navy	53,897
Other	3,999
Department of the Interior, total	12,820
Bureau of Reclamation	145
Geological Survey	11,985
National Park Service	290
Office of Water Research & Technology	400
Bureau of Land Management	0
Environmental Protection Agency	911
NASA	23,030
NSF[2]	96,325
Smithsonian Institution	913
U.S. Arms Control & Disarmament Agency	34
TOTAL	$261,684

[1] National Science Foundation: Federal Funds for Research and Development FY 1981, 1982, 1983. Vol. XXXI, NSF 82-326. Tables C24, 25, 26.

[2] These totals for NSF include funds for the Deep Sea Drilling Project and oceanography-related activities in NSF division in addition to NSF's ocean science division.

TABLE A2-3: ACADEMIC INSTITUTIONS RECEIVING THE LARGEST SHARE OF GRANTS AND CONTRACTS FOR OCEAN SCIENCES FROM NOAA, ONR, AND NSF*

NOAA

A. Sea Grant College Program[1] FY 81 (millions)

1.	U. California	$ 5.17
2.	U. Washington	4.21
3.	U. Alaska	2.54
4.	U. North Carolina	2.35
5.	Oregon SG Program	2.34
6.	New York SG Institute	2.00
7.	Texas A&M University	1.79
8.	U. Rhode Island	1.76
9.	U. Hawaii	1.70
10.	MIT	1.70
11.	All Other Institutions	14.43
	TOTAL	$39.98

The top 10 institutions received 64% of this total. Note, these funds represent the total to be administered by the particular institution.

B. National Undersea Research Program[2] FY 82

1.	Woods Hole	$ 946,000
2.	U. Hawaii	860,000
3.	Fairleigh Dickinson U.	529,000
4.	U. North Carolina	200,000
5.	U. Southern California	115,000
6.	All Other Institutions	254,000
	TOTAL	$2,904,000

The top 5 institutions received 91% of this total:

C. Saltonstall-Kennedy Program[3]

A breakdown by university is unavailable. Table A2-6 shows S-K projects funded in the Northeast.

ONR

FY 82 (millions)[4]

1.	Woods Hole	$ 6.5
2.	U. California (Scripps)	5.1
3.	Lamont-Doherty	4.2
4.	U. Washington	4.0
5.	Oregon State U.	2.5
6.	MIT	2.0
7.	U. Miami	1.7
8.	U. Rhode Island	1.6
9.	U. Hawaii	1.5
10.	Texas A&M University	.8
11.	All Other Institutions	12.9
	TOTAL	$42.8

The top 10 institutions received 70% of this total.

NSF

FY 82 (millions)[5]

1.	U. California (Scripps)	$35.53
2.	Woods Hole	19.32
3.	Lamont-Doherty	7.11
4.	U. Alaska	5.50
5.	U. Miami	5.43
6.	Oregon State University	5.29
7.	U. Rhode Island	4.88
8.	U. Washington	4.79
9.	U. Hawaii	4.32
10.	Texas A&M University	2.86
11.	All Other Institutions	2.23
	TOTAL	$97.26

The top 10 institutions received 97% of this total.

*See following page for footnotes and source information.

[1]U.S. House of Representatives Appropriations Committee, Subcommittee on Commerce, Justice, State, and the Judiciary Appropriation. Hearings on the Department of Commerce 1983 budget request by John V. Byrne, March 1983. page 1086; State University of New York at Stony Brook. Marine Sciences Research Center. Annual Report, 1980-82. July 15, 1982. page 2-5; Communication with Ms. M. Neal-Brown, Fiscal/Administrative Officer, California Sea Grant College Program Office, July 8, 1983; Scripps Institution of Oceanography received $986,174 from the California SG College Program in NOAA SG Funds in FY 81. The Marine Sciences Research Center of SUNY at Stony Brook received approximately $198,074 from the New York SG Institute in NOAA SG funds in FY 81. The figures for all other institutions and the percentage allocated to the top 10 institutions were determined by RMFA.

[2]Communication with Dr. Finkle, Director of the National Undersea Research Program, June 29, 1983. The figure for all other institutions was determined by RMFA from the total funds allocated for Science Support, and Diving Research and Development (bio-medical research).

[3]U.S. Department of Commerce, National Oceanic & Atmospheric Administration, National Marine Fisheries Service, Fisheries Development Report 1980-1981, 1982.

[4]Communication with Mr. G. Hamilton, Associate Director of Environmental Sciences Directorate, ONR, June 27, 1983; Mr. R. Lightle, Head, Budget Branch, ONR, June 22, 1983. The figures for all other institutions and the percentage to the top 10 institutions were determined by RMFA.

[5]National Science Foundation, Division of Ocean Sciences. "Sources of Oceanography Support for 17 Major UNOLS Institutions FY 1981 and FY 1982". The figures for individual institutions and the total to all other institutions were determined by RMFA. The total allocated to Scripps includes $22,234,000 for the Deep Sea Drilling Project (DSDP).

TABLE A2-4: NATIONAL SEA GRANT COLLEGE PROGRAM
GRANTS AWARDED IN FISCAL YEAR 1981[1]

GRANTEE	FEDERAL	MATCH
University of Alaska SG College Program	$ 2,540,000	$ 2,443.936
University of Arizona	32,500	44,000
University of California SG College Program	5,166,200	2,547,746
University of Southern California SG Program	615,000	489,323
°University of Connecticut	115,000	81,405
University of Delaware SG College Program	1,487,600	1,042,689
National Fisheries Institute	26,000	15,000
Florida SG College Program	1,675,700	1,131,400
Georgia SG College Program	875,000	907,500
University of Hawaii SG College Program	1,700,000	1,340,304
Louisiana SG College Program	1,250,000	670,145
°University of Maine/University of New Hampshire SG College Program[2]	1,525,000	896,992
University of Maryland SG Program	1,000,000	611,187
°Mass. Institute of Technology SG College Program	1,699,000	1,053,110
°Harvard University	60,000	30,000
°Woods Hole Oceanographic Institution SG Progam	869,700	525,644
Minnesota SG Program	535,000	273,800
Mississippi-Alabama SB Consortium	910,000	456,500
°University of New Hampshire	107,000	53,500
°New Jersey Marine Sciences Consortium	504,000	393,390
°Rutgers University	25,000	0
°New York SG Institute	2,001,000	1,090,257
University of North Carolina SG College Program	2,350,000	1,210,000
LaQue Center for Corrosion Technology, Inc. Wrightville Beach	62,000	0
Ohio SG Program	354,000	242,961
University of Oklahoma	150,000	75,000
Oregon SG College Program	2,343,900	1,604,500
°University of Rhode Island SG College Program	1,759,500	858,898
°National SG Depository, University of Rhode Island	98,600	0
South Carolina SG Consortium	525,000	478,400
Texas A&M University SG College Program	1,787,500	1,513,500
Virginia Graduate Marine Science Consortium	1,319,000	897,757
Virginia Institute of Marine Science	2,630	0
Virginia Polytechnic Institute - Sea Grant 70s/Sea Grant Study	104,400	6,400
University of Washington SG College Program	4,205,500	2,789,100
University of Puerto Rico Sea Grant Program	210,000	159,200
TOTALS	$39,982,430	$25,923,544

°Indicates those institutions located in the Northeast.

[1] U.S. House of Representatives Appropriations Committee, Subcommittee on Commerce, Justice, State and the Judiciary Appropriations. Hearings on the Department of Commerce 1983 budget request by John V. Byrne, March 5, 1982, page 1086.

[2] Grant administered jointly.

TABLE A2-5: NOAA SEA GRANT PROGRAM[1] GRANTS BY STATE

STATE	FY 82	FY 83
Alaska	$ 1,515,000	$ 0
California	3,625,000	0
Connecticut	250,000	0
Delaware	174,800	1,194,400
District of Columbia	4,000	7,000
Florida	1,755,100	1,618,318
Georgia	875,000	0
Hawaii	1,710,000	0
Illinois	80,500	100,000
Louisiana	1,260,400	0
Maine/New Hampshire[2]	1,500,000	1,350,000
Maryland	998,200	998,200
Massachusetts	2,609,100	2,398,800
Michigan	1,091,400	1,000,000
Minnesota	535,000	0
Mississippi/Alabama[2]	82,910	83,900
New Jersey	520,000	525,000
New York	2,000,000	2,000,000
North Carolina	63,100	1,239,500
Ohio	402,900	0
Oklahoma	0	81,000
Oregon	2,140,000	0
Rhode Island	1,621,200	1,623,000
South Carolina	496,400	0
Texas	1,720,000	0
Virginia	1,438,100	1,315,000
Washington	811,500	2,304,000
Wisconsin	2,853,500	1,003,000
Puerto Rico	240,000	255,000
TOTAL	$32,273,930	$19,096,118

[1] Totals of grants awarded as of June 3, 1983, as reported by Robert D. Wildman, Deputy Director, Office of Sea Grant. The NOAA request for the Program in FY 84 is zero.

[2] Grants administered jointly..

TABLE A2-6: SALTONSTALL-KENNEDY PROJECTS FUNDED IN THE NORTHEAST FOR FY '81[1]

NEW ENGLAND FISHERIES DEVELOPMENT FOUNDATION[2] Boston, Massachusetts	
New Bedford Quality Improvement	$ 177,500
Quality Improvement Through In-Plant Training	90,000
Coordinated Seafood Marketing Plan	210,000
Stabilization of Texture-Frozen Red Hake	45,000
European Market Information System	193,700
Trawl Gear Development/Demonstration	40,000
Regional Seafood Export Program	60,000
Audio-Visual Loan Center/Gear & Fish Behavior	11,000
Foundation Operations and Special Projects	186,400
Subtotal	1,013,600
DIRECT AWARDS	
East Coast Automated Longline Demonstration Development Sciences, Inc. Sagamore, Massachusetts	65,000
Energy Production in the form of Bio-Fuel from Marine Wastes Tide Energy Associates Kennebunkport, Maine	35,000
Commercial Facility to Dry Squid, Butterfish, and Other Underutilized Species Scarab Corporation Manchester, Massachusetts	30,000
NATIONAL PROJECTS	
Role of Dormant Cysts in Toxic Red Tides and Shellfish Toxicity Woods Hole Oceanographic Institution Woods Hole, Massachusetts	48,700
NMFS RESEARCH AND DEVELOPMENT PROJECTS	
New Bedford Quality Improvement	18,000
TOTAL	$ 1,210,300

[1] NMFS, Fisheries Development Report 1980-81, pp. 26 and 27 and Attachment A.

[2] Some of the funds shown above as being awarded to the New England Fisheries Development Foundation may have been passed through to universities; a breakdown by university is not available.

TABLE A2-7: NOAA FACILITIES IN THE NORTHEAST

National Marine Fisheries Service	
Northeast Fisheries Center Woods Hole, Massachusetts	Northeast administrative headquarters of NMFS for laboratories in Gloucester and Woods Hole, Massachusetts; Narragansett, Rhode Island; Milford, Connecticut; Highlands, New Jersey; and Oxford, Maryland. Research concerns resource assessment: populations, distributions and sizes in the short term, with emphasis on harvested marine resources.
Narragansett Laboratory and Atlantic Environmental Group Narragansett, Rhode Island	Research on fish stocks, the continental shelf ecosystem (population dynamics), migration studies, biostatistics and remote sensing. AEG: Analyze long-term meteorological and oceanographic data useful for describing environmental features, processes, and trends which may influence living marine resources.
Milford Laboratory Milford, Connecticut	Research to determine effects of environmental factors on marine resources of New England and Long Island Sound waters. Aquaculture research on oysters, and other mollusks for commercial production.
Sandy Hook Laboratory Highlands, New Jersey	Research on environmental pollution as it affects fish resources. Research on fisheries concerning management, population assessments, and distributions.
Gloucester Laboratory Gloucester, Massachusetts	Research involving the utilization of marine finfish resources resources as food including processing, methods of preservation, canning, freezing, quality characteristics and standards, and finding new uses for underutilized species.
Environmental Research Laboratory	
Geophysical Fluid Dynamics Laboratory Princeton, New Jersey	Numerical simulation (modeling) of atmospheric and ocean processes for practical applications such as the improvement of extended range forecasts, and for improved understanding of the behavior of severe weather patterns. Studies are applicable to national and global scales.

TABLE A2-8: MAJOR FEDERAL FUNDING FOR OCEAN SCIENCES AVAILABLE TO ACADEMICALLY-LINKED INSTITUTIONS (Thousands of Dollars)

AGENCY	FY 81	FY 82	FY 83
NSF[1]			
Ocean Science Research	$47,400	$46,907	$ 49,700
Ocean Facilities and Support	27,600	28,123	31,476
Deep Sea Drilling Project	19,960	22,234	21,000
TOTAL	$94,960	$97,264	$102,176
NOAA			
Sea Grant[2]	39,982	32,373	35,000
NURP[3]	N/A	2,904	2,498
Saltonstall-Kennedy[4]	N/A	N/A	N/A
TOTAL	$39,982	$35,277	$ 37,498
ONR[5]			
Academic Institutions	$34,444	$42,821	$ 44,000

[1]Communications with Mr. R. LaCount, Head of Oceanographic Facilities and Support Section; Mr. J. McMillan, Ship Operations; NSF Ocean Sciences Division "Sources of Oceanography Support for 17 Major UNOLS Institutions FY 1981 and 1982". These figures do not include funds from NSF divisions other than the Ocean Sciences Division.

[2]U.S. House of Representatives Appropriations Committee, Subcommittee on Commerce, Justice, State and the Judiciary Appropriations. Hearings on the Department of Commerce 1983 budget request by John V. Byrne, March 5, 1982, page 1086; communication with Mr. R. Wildman, Deputy Director, Office of Sea Grant. The figure for FY 83 represents the total allocated to the program under the Congressional continuing resolution. Actual total allocated to academic institutions at this time is unavailable.

[3]Communication with Dr. E. Finkle, Director of National Undersea Research Program, June 1983. FY 83 figures as of June 24, 1983. The portion of the total NURP budget available to academic institutions was determined by RMFA.

[4]NMFS, Fisheries Development Report 1980-81, 1982. Some of the funds allocated to Regional Fisheries Development Foundations may have been passed through to universities; a breakdown by university is not available.

[5]Communications with Mr. G. Hamilton, Associate Director for Environmental Sciences Directorate; Mr. R. Lightle, Head, Budget Branch. The figure for FY 83 was estimated by the ONR.

APPENDIX 3

APPENDIX 3: MARINE-RELATED NEEDS SURVEY

A. INTRODUCTION

In conformity with the methodology established by NOAA for the conduct of this study, a wide range of known and potential users of the marine-related activities offered by UCONN at Avery Point were surveyed to determine their perception of current and projected needs. Among those contacted were representatives of marine-related businesses, industrial firms, utilities, commercial fishermen's associations, environmental groups, educational institutions, public agencies, non-profit marine centers, and individual members of the State legislature. Appendix 4 lists the individuals who were interviewed and their organizational affiliation. For purposes of analyzing the responses, we have identified three major user groups: business (including marine and non-marine related business), government, and educational institutions.

A total of 75 telephone interviews were conducted, of which 17 were with educational institutions, 24 were with government-related organizations, and 34 were with marine-related businesses, membership groups and others. Responses to the survey are discussed in Part B below.

In addition to surveying the primary user groups, extensive discussions were held with representatives of the research, extension and educational units at the Avery Point campus to obtain their perspectives on projected needs relative to their areas of endeavor. Their views are discussed in Part C.

Part D of this appendix compares the needs identified by the user groups with the activities and services now provided by UCONN's marine research, educational, and outreach programs at the Avery Point campus. The purpose of the comparison is to identify unmet needs.

The marine related needs that were identified by the user groups, as well as by UCONN's Avery Point units fall in three functional areas -- research,

education, extension[1] -- and are summarized below.

B. USER GROUP CONCERNS

1. Research

Research was the major need identified by all three user groups. Research areas accorded high priority were water pollution, commercial fisheries, and cooperative activities.

a. Water Pollution. The major concern expressed by the business group[2] was for continued and expanded research into the pollution problems of Long Island Sound (LIS) and adjacent estuarine and coastal areas. Studies were deemed to be needed on: the impacts of dredging, especially as it relates to commercial fish and shellfish resources; pollution impacts on shellfish from high coliform counts and high concentrations of trace metals; and the impacts of water quality in LIS as it affects recreation and tourism. Additionally, the governmental group expressed a need for research on alternatives for ocean disposal of dredged material.

b. Commercial Fisheries. A second area of concern to both the business and government groups was the need for continued and expanded research on commercial fisheries resources -- species populations and distribution; long-term studies of the lobster; study of commercially underutilized species such as hake, surf clam, and flounder; and, research leading to the improvement of aquacultural techniques for oysters and scallops.

c. Cooperative Research. The primary need expressed by educational institutions was for the establishment of cooperative or joint research efforts in estuarine and coastal environments. This

[1] As used here, the distinction between extension and education is in the audience to whom information is presented. Extension services are directed towards all segments of the public concerned with marine resources. Educational services are directed toward a more formalized or degree-oriented audience.

[2] This user group category consists of business, including marine-related business, business associations, and membership organizations.

kind of cooperative relationship would allow researchers at other educational institutions access to the Avery Point laboratories, specialized equipment, and vessels.

2. Education

Educational needs were not emphasized as strongly as were the research concerns discussed above. Of the government agencies surveyed, none indicated a need for additional marine-related educational activities that they wished to have supplied by Avery Point. The user group comprised of other educational institutions identified four areas of potential need.

a. Cooperation and Sharing of Resources. Both public and private institutions of higher education cited the potential for joint offerings in marine education at both undergraduate and graduate levels. Institutions offering marine-related courses not taught elsewhere could make these classes available to students of other institutions (with credit transferable, thus providing a better and more diversified curriculum).

b. Graduate Level Marine Science Education. Expansion of marine science graduate courses and programs at Avery Point in the areas of physical, chemical, geological, and geophysical oceanography. (Biological oceanographic coverage was considered sufficient at its current level.)

c. On-the-Water Training. Increased use of the on-the-water training in marine science undergraduate and graduate courses, including, the cooperative use of vessels at Avery Point.

d. Marine Education for the General Public. Expanded general public (non-degree) marine education.

The third user group, consisting of business (marine and non-marine related) and membership organizations, expressed two non-marine educational needs that could be supplied by Avery Point.

a. Graduate Level Basic Science Education. The expansion of graduate education, especially in the evening, in the basic sciences (physics, chemistry, and geology) as well as computer sciences and mathematics, in support of marine science education at Avery Point.

b. Graduate Level Engineering Education. A need was expressed for graduate electrical and mechanical engineering education at Avery Point, especially in the evening, in support of the local marine technical community.

3. Extension

The user groups expressed a recognition of the importance of extension services and a general satisfaction with the extension program of the Marine Advisory Service. However, the marine-related businesses and membership organizations did emphasize the need for extension services in several areas.

a. Business and Financial Management. Greater support to marine business, especially commercial fishermen, on business management, financial planning and tax information.

b. Marine Technology. Increased provision of net, gear, and navigational (LORAN-C) technology for the commercial fishing industry.

The president of a large fishermen's association indicated that the organization looked to the Marine Advisory Service at Avery Point as a source of information on the business and technological aspects of commercial fishing operations, including training workshops on net and gear technology.

c. Commercial Fisheries. Increased promotion of fisheries production, processing, marketing and distribution in Connecticut, including: increased seabed utilization by the oyster industry; stocking and re-establishment of shellfish stocks; and daily monitoring (by a person -- not a voluntary log book) at the Stonington Town Dock of fishermen's catch (to direct future fishing endeavors).

d. Weather Information. Provision of localized weather information for Long Island Sound including satellite imagery.

A senior staff member of a large area firm stated, with regard to future research, that his company had need for better access to weather and satellite imagery information relevant to coastal marine resources.

The user group consisting of government agencies did not register any concern for marine extension services for their own use, but did see the need for increased extension services to the general public on marine matters. Educational institutions did not, as a group, express any need for additional marine extension services at Avery Point.

C. NEEDS EXPRESSED BY AVERY POINT UNITS

This section identifies those areas of research, education and extension that are of current and future interest to the key representatives of the Avery Point marine science units. By far, their most obvious concern was for greatly expanded marine research efforts, with primary concentration on Long Island Sound and adjacent waters. Strong interest also focused on providing graduate level courses in the related sciences at the Avery Point campus; and, expanding student enrollment, faculty, and curriculum, at the graduate level, in oceanography. There was uniform interest in sustaining and augmenting the extension program provided by the Marine Advisory Service. Additional detail on these areas of perceived need is given below.

1. Research

The Avery Point marine science units registered a need for growth in six areas.

a. Biological Oceanography. Greatest concern was expressed for expanded research in biological oceanography. The needed research focus was seen to include studies of trace metals in commercially important organisms; life history and management studies of the hard clam; behavior, distribution patterns, and habitat selection of commercial fish stocks (lobster, shrimp, crab, clam, scallop, hake, cod, haddock, and flounder); growth processes affecting crustacean resources; management and production of LIS oysters; and bioluminescense as an indicator of environmental stress.

b. Dredging/Sediment Studies. A need was seen for an expansion of applied research with emphasis on dredging and resultant impacts. Needed areas of study included: disposal site selection; alternative forms of containment; benthic impacts; fisheries response; benthos recolonization; and long-term monitoring. Related research would focus on sediment studies: organism-sediment relationships; sediment transport as it involves beach and shoreline erosion; and, sediment distribution and processes related to distribution of pollutants and dredge spoil sites.

c. Marine Technology. The third area of concern of the Avery Point marine entities was research in marine technology. Study needs were seen to include improved design of commercial fishing nets and gear; expanded and complementary research efforts with the Coast Guard R&D Center on marine safety; investigations of bioluminescence as an indicator of submarine detection; and the effects of bioturbation processes on bottom acoustic characteristics.

d. Study of Submarine Canyons. Research on the origins and developmental histories of the submarine canyons of the continental shelf and shelf edge was also seen as a needed research direction.

e. Cooperative Research. Cooperative research ventures with educational and other institutions was also of interest to the Avery Point representatives. The focus of this cooperative research would probably center on estuarine and coastal processes and problems.

f. Related Facility Needs. Other needs expressed by the marine groups at Avery Point related to improved facilities for conducting research, particularly the need for improved and additional dockage, laboratories, and the upgrading and acquisition of specialized equipment and vessels.

2. Education

Strong concern for marine education was stressed by the Avery Point units, although it was not emphasized as vigorously as were marine

research concerns. Marine-related educational concerns are summarized as follows.

a. Graduate Level Education. The major educational interest was to provide graduate level courses in the basic sciences (geology, geophysics, chemistry, and biology) at the Avery Point campus in support of the existing graduate level marine science courses.

b. Graduate Level Marine Science Education. The need for the expansion of existing graduate level marine science courses in all areas of oceanography (physical, chemical, biological, geological, and geophysical) at the Avery Point campus was also expressed.

c. Cooperative Marine Education. The Avery Point entities would welcome greater access to marine sciences courses through the establishment of cooperative relationships with other educational institutions.

d. General Marine Education. An additional concern was expressed for increased general marine education for elementary and secondary school children, especially for on-vessel orientation to the marine environment.

3. Extension

Avery Point's marine units, including representatives of the teaching and scientific groups, expressed concern for the continuation and expansion of extension programs, especially those related to the commercial fishing industry. Need for expanded outreach services were seen in the following areas.

a. Finance and Management. Providing marine-related business with economic, taxation, finance and marketing information and training.

b. Marine Technology. This would include net, gear, engine, navigational and marine safety components.

c. Commercial Fisheries. Transfer of research findings of the academic and scientific community to the commercial fisheries sector as those findings relate to production, processing, marketing and distribution.

d. Aquaculture. Continued bay scallop studies including population dynamics, ecology and aquacultural techniques. Assistance in the development of a state vocational-agriculture program in fisheries and aquaculture.

e. Municipal Coastal Planning. This would include planning advice to coastal towns on port and harbor development, commercial fishing and recreational boating facilities, and marine resources management.

f. State and Federal Agencies. Continued service to government departments, such as Connecticut's DOA Aquaculture Division, the DEP Marine Region and CAM Office, as well as such Federal agencies as NOAA, NMFS, CoE, EPA, and USGS.

g. General Public. Programs and information services to make the public more aware of marine resources.

D. UNMET NEEDS: USER GROUP CONCERNS VS. CURRENT MARINE PROGRAMS AT UCONN'S AVERY POINT CAMPUS

This section will address the extent to which a gap exists between the expressed "marine needs" of the user groups and the research, extension and educational activities now being conducted by the Marine Science units at Avery Point.

1. Research

Past and current research projects of the Avery Point units generally cover all of the user group research concerns. This is evidenced by the MSI's research contracts over the past five years. Research emphasis has clearly focused on pollution in the coastal and Long Island Sound environments. Subject area coverage includes.

a. Trace metal investigations
b. Dredging and dredge spoil disposal projects including monitoring and environmental surveillance
c. Organism-sediment relationships
d. Sediment transport
e. Connecticut shoreline dynamics

f. Geochemistry of certain metalloids in U.S. rivers

g. Sea-air and air-sea exchanges of mercury

h. Hydrocarbon burdens in sediments of benthic organisms

i. Benthic community studies

j. Effects of energy related transport activities of benthic organisms in the Thames River area

k. Life history and resource management of the hardshell clam

l. Estuarine studies.

Overall, the needs expressed by user groups in relation to marine research are supportive of MSI's current research efforts. The consensus is for continued and expanded research efforts to ensure the protection of marine environmental quality and the productive use of marine resources in Connecticut and Long Island Sound.

2. Education

The Marine Sciences Department (MSD) curriculum, which depends heavily on graduate basic science courses, provided by other University departments, covers all aspects of oceanography, but is strongest in biological oceanography. The Department expressed a desire for expanded graduate level oceanography curriculum in all areas except biological oceanography, which is currently well represented. It also suggested the provision of graduate level basic science courses in chemistry, physics, geology, and geophysics at the Avery Point campus, so that marine science graduate students would not have to travel to Storrs for such courses.

The business groups registered the need for Avery Point to offer graduate level engineering programs in the evenings. Currently, this need is being met by a private institution, the University of New Haven, which conducts courses at a local high school and at a local community college. The only other option now available to local students is to travel to New Haven, Storrs, Hartford, or to the University of Rhode Island for graduate level engineering courses. Although the engineering course need is not marine-related, such program offerings would serve the marine-industrial and business community of the Groton/New London/ Norwich triangle.

Concerning cooperative marine education, the Avery Point units have initiated several efforts. The Mystic Marinelife Aquarium and the Marine Sciences Department currently jointly provide two undergraduate credit courses at the aquarium. In addition, the MSD is in the discussion stage of developing joint marine courses with Connecticut College.

The MSD is also investigating the possibility of additional cooperative or joint marine science courses with the Coast Guard Adacemy, Eastern Connecticut State University, Wesleyan University, and Mitchell College, although no formal discussions have been held to date.

Regarding marine education for the general public, and non-degree programs for elementary through high school, Project Oceanology satisfied basic user group concerns. There appears to be a need to expand existing programs, making them available at lower cost to allow this introductory marine education to become available to more school systems.

3. Extension

Expressed needs for extension services are being adequately met by the Marine Advisory Service. Programs for business-related economic information, technology, commercial fisheries data, coastal resource planning, aquaculture, and informational services to State and Federal agencies and the general public are currently underway. These activities are expected to continue, and hopefully to expand to meet the growing extension needs of the marine community. Table A3-1 outlines some of the State, Federal, and private organizations the MAS routinely deals with. Table A3-2 summarizes selected accomplishments of the MAS during this past year.

The one area of user group extension concern that appears to be somewhat unattended to, is localized Long Island Sound marine weather forecasting. This concern is being addressed in the 1983-84 Sea Grant Proposal for funding and by current MAS efforts to coordinate the National Weather Services -- MAREPS Program with Long Island Sound mariners.

Overall, however, the advisory and technical assistance services seem to be on target and well received. User group needs for extension services are in the direction of a continuation and expansion of existing programs.

TABLE A3-1: SELECTED AGENCIES AND GROUPS FOR WHICH SERVICES ARE PROVIDED BY THE MARINE ADVISORY SERVICE

Federal Organizations

NMFS, Milford - cooperative relationship on the rehabilitation of bay scallop beds.

NMFS, Sandy Hook - assisted in monitoring of marine organisms.

NMFS, Northeast Fisheries Center - assisted in the establishment of sampling stations of deep ocean pollution assessment on the inner margins of the continental shelf.

Connecticut Organizations

Department of Environmental Protection, Marine Region - informal working relationship and advice on the creation of a voluntary log book system for daily fishermen's catch.

Department of Environmental Protection, Water Compliance Unit - assisted in developing criteria for regulating pollutant loads generated by dredge spoil disposal operations in Connecticut marine waters.

Department of Environmental Protection, Coastal Area Management Unit - informal working relationship and advice on the technical aspects of the coastal environment.

Health Department - assisted in developing depuration code standards for shellfish harvesting.

DOA Aquaculture Division - informal working relationship provides information on seabed leasing for shellfish; also assisted in drafting a bill to establish a Connecticut Aquaculture Commission to promote the farming of State waters (currently pending in Connecticut Legislature).

Department of Economic Development - provided information on marine tourism and coastal recreational resources.

State Legislature - provides technical advice and information on Connecticut marine resources.

Municipalities

Provides information and workshops for municipal planning and resource agencies in Connecticut on coastal resource management issues and methods.

Private Organizations

Informal relationship with several private educational institutions, such as Project Oceanology, Schooner, Inc., and the Oceanic Society, providing information, advice, and promoting introductory marine education for the general public.

Works with many commercial fisheries associations, marinas, individual fishermen, non-profit organizations and many other marine-related businesses and organizations.

TABLE A3-2: MARINE ADVISORY SERVICE SELECTED ACCOMPLISHMENTS 1981-82[1]

Fisheries (Port Development)

Planning sessions for fisheries consideration in port development in Stonington, New Haven, Bridgeport, Norwalk and Stamford.

Consultations with Connecticut CAM program on consideration for fisheries terminal needs.

Fisheries (Gear Technology)

Short courses on design, construction and repair of nets.

Net construction guide publications.

Lectures on small-scale fisheries techniques.

Aquaculture

Studies of the bay scallop in cooperation with NOAA-NMFS Milford Lab.

In-service training program for Vocational-Agriculture instructors in fisheries/aquaculture.

Marine Environmental Quality

Information forums and involvement in environmental monitoring of dredge disposal in Long Island Sound.

Marine Education

Many conferences, seminars, and exhibits were held.

Marine Economics Research/Advisory Cooperation

With the UCONN Agricultural Economics Department, studied Connecticut's charter boat fleet.

Studies of commercial and recreational striped bass fishing.

Marine Recreation Business

Workshops for marina operators.

Fishing Financial Management

Workshops on tax management techniques and financial assistance programs.

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[1]Adapted from Connecticut Sea Grant Coherent Project Proposal - 1983-84, Volume 2, pages 227-233.

APPENDIX 4

APPENDIX 4: LIST OF INDIVIDUALS AND ORGANIZATIONS CONTACTED

GOVERNMENT AGENCIES

Federal Agencies

Department of the Army

Army Corps of Engineers - New England District
Waltham, Massachusetts
Mr. Vito Andrelunis, Chief of Operations, "DAMOS" Project
Mr. William Scully, Chief of Programs Office

Department of Commerce

National Oceanic and Atmospheric Administration

National Marine Fisheries Service

Office of Utilization and Development
Mr. Roger Hutchinson, Washington, D.C.
Mr. John Lineham, Industrial Specialist, New Bedford, Massachusetts

Northeast Fisheries Center, Woods Hole, Massachusetts
Mr. John Gibson, Public Affairs

Gloucester Laboratory, Gloucester, Massachusetts
Mr. Joseph Licciardello, Acting Director

Milford Laboratory, Milford, Connecticut
Dr. James Hanks, Director

Narragansett Laboratory and Atlantic Environmental Group
Dr. Kenneth Sherman, Director
Mr. Stephen Cook, Oceanographer

Sandy Hook Laboratory, Highlands, New Jersey
Dr. Carl Sinderman, Director

National Ocean Service, Rockville, Maryland
Dr. John Cawley, Director of Systems Planning

Office of Oceanic and Atmospheric Research, Rockville, Maryland
Mr. Robert Wildman, Deputy Director, Office of Sea Grant
Dr. Elliott Finkle, Acting Director, Undersea Research Program

Office of Budget and Resource Management, Rockville, Maryland
Diane Kenlon, Eileen Shea

Department of the Interior

Fish and Wildlife Service, Region 5
Newton Center, Massachusetts
Mr. David Alan, Assistant Regional Director for Fisheries Resources

Geological Survey
Atlantic Marine Geology Branch, Woods Hole, Massachusetts
Sally Needell, Physical Scientist

Department of the Navy

Office of Naval Research, Arlington, Virginia
Mr. Gordon Hamilton, Director, Environmental Sciences Directorate
Mr. Randy Lightle, Head, Budget Branch
Donna Dennison, Environmental Sciences Directorate
Brenda Batch, Environmental Sciences Directorate
Lt. Commander Brian McDonald, Naval Oceanographic Office (Bay St. Louis, MS)

Naval Underwater Systems Center, New London, Connecticut
Mr. Lacoe, Public Affairs
Dr. William Von Winkle, Associate Technical Director
Dr. Charles Brown

Naval Submarine Base, New London, Connecticut
Lt. Commander Estrade, Public Affairs
Katrina Johnson, Naval Submarine Medical Research Lab

Department of Transportation

U.S. Coast Guard Research and Development Center
Avery Point, Groton, Connecticut
Mr. Michael D'Angelo, Assistant Technical Director
Mr. Samuel Powel, Technical Director

Environmental Protection Agency

Region 1 Office, Boston, Massachusetts
Mr. Peter Holmes, Ocean Dumping Coordinator

Environmental Research Laboratory, Narragansett, Rhode Island
Dr. William Brungs, Deputy Director

National Science Foundation, Washington, D.C.

Dr. M. Grant Gross, Director Ocean Sciences Division
Dr. Robert Wall, Head, Ocean Sciences Research Section
Mr. William Blanpied, Head, Office of Special Projects
Mr. Ronald LaCount, Head, Oceanographic Facilities Support Section
Mr. John McMillan, Head, Ship Operations

State Agencies

Connecticut Area Cooperative Education Service
Hamden, Connecticut
Mr. Larry Schaefer, Director of School Services Unit

Connecticut Department of Agriculture, Aquaculture Division
Milford, Connecticut
Mr. John Volk, Division Chief

Connecticut Department of Environmental Protection, Marine Region
Waterford, Connecticut
Mr. Eric Smith, Assistant Director - Marine Fisheries Bureau

Connecticut Department of Environmental Protection
Office of Planning and Coordination, Coastal Management Unit
Hartford, Connecticut
Mr. Arthur Rocque, Director
Mr. John Wiggin, Senior Environmental Analyst

Connecticut Department of Labor
Hartford, Connecticut
Mr. Gary McDonald, Director of Economic Analysis Unit

Connecticut Development Authority
Hartford, Connecticut
Mr. Edward Zalinsky, Loan Officer

Connecticut State Board of Higher Education
Hartford, Connecticut
Mr. Dennis Cooley, Mr. Merle Harris, Mr. Joseph Joyce

Connecticut State Legislature
Hartford, Connecticut
Representative Dorothy Goodwin, Co-Chairman, Education Committee
Representative Janet Polinsky, Co-Chairman, Appropriations Committee
Senator Richard C. Schneller, Senate Majority Leader
Stephen Davis, Legislative Aide to Senator Richard Schneller

Local Agencies

Groton, City of
Groton, Connecticut
Mr. Eliot Barnes, Building Inspector and Zoning Enforcement Officer

Groton, Town of
Groton, Connecticut
Mr. Mark Oefinger, Director of Planning

New London, City of
Marine Commerce Development Committee
New London, Connecticut
Mr. Michael Lamparelli, Director

Stonington, Town of
Stonington, Connecticut
Marcia Blaun, Coastal Area Management Officer

Regional Agencies

Atlantic States Marine Fisheries Commission
Washington, D.C.
Mr. Irwin Alperin, Executive Director

New England Fisheries Development Foundation
Boston, Massachusetts
Mr. Kenneth Coons, Director

New England Fisheries Management Council
Saugus, Massachusetts
Mr. Howard Russell, Staff

Southeastern Connecticut Regional Planning Agency
Norwich, Connecticut
Mr. Gary Amt, Assistant Director

EDUCATIONAL INSTITUTIONS

Columbia University
Lamont-Doherty Geological Observatory
Palisades, New York
Jean Shampeau, Administrator of Marine Geology and Geophysics Division
Rosemarie Cline, Administrator of Oceans and Climate Division

Connecticut College
New London, Connecticut
Dr. Fell, Professor of Zoology

Eastern Connecticut State University
Willimantic, Connecticut
Dr. Elliot, Chairman of Biology Department
Dr. Ralph Yulo, Professor of Education

Grasso Southeastern Regional Vocational Technical School
Groton, Connecticut
Mr. White, Director

Hartford Graduate Center
Hartford, Connecticut
Ms. Alice Gould, Entry Specialist

Marine Biological Laboratory
Woods Hole, Massachusetts

Marine Technology Society of New England
Marion, Massachusetts
Mr. Geoffrey Morrison, Member

Massachusetts Institute of Technology (MIT)
Cambridge, Massachusetts
Mr. Art Clifton, Marine Science Liaison Officer

Massachusetts Maritime Academy
Buzzards Bay, Massachusetts
Captain Jeffrey Motte, Vice President Academic Affairs

Mitchell College
New London, Connecticut
Professor Theodore Hatfield, Public Relations Director

Mohegan Community College
Norwich, Connecticut
Dr. Stanley Gaby, Professor of Earth Science

Mystic Education Center
Mystic, Connecticut
Mr. Diamond, Administrator

New York State Sea Grant Extension Program
Riverhead, New York
Mr. John Scotto, Regional Extension Specialist

Project Oceanology
Avery Point, Groton, Connecticut
Dr. Howard Weiss, Director

Rutgers University
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Susan Ford, Technician, Oyster Research Laboratory

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Stony Brook, New York
Dr. Edward Carpenter, Associate Professor
Dr. Donald Pritchard, Associate Director for Research, Marine Science Research Center
Jeri Schoof, Assistant to Director and Public Affairs Officer

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New Haven, Connecticut
Dr. Peter Pellagrino, Associate Professor of Biology

Thames Valley State Technical College
Montville, Connecticut
Mr. Donald Water, President

United States Coast Guard Academy
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Captain Kolmyer, Chairman of Physical and Ocean Sciences Department

University of California - San Diego
Scripps Institute of Oceanography
La Jolla, California
Jill C. Hammons, Public Affairs Office

University of Connecticut
Storrs, Connecticut
Dr. John DiBiaggio, President
Dr. Anthony DiBenedetto, Vice President for Academic Affairs
Dr. Julius Elias, Dean, College of Liberal Arts
Dr. Lewis Katz, Acting Vice President for Graduate Education and Research
Mr. Glenn Rosenberg, Director of Budget Development
Mr. David Herman, Director of Grants and Contracts

University of Connecticut
Avery Point, Groton, Connecticut
Dr. James Baird, Director of Avery Point Campus
Mr. Victor Boatwright, Connecticut Sea Grant Advisory Committee Member
Mr. Cal Crouch, Administrative Assistant, Marine Sciences Institute
Dr. Sung Y. Feng, Director of Marine Sciences Institute and Acting Head, Marine Sciences Department
Dr. Robert Goode, Ocean Engineering Program, Marine Sciences Department
Mr. Janney, Business Manager, Avery Point Campus
Dr. Lance Stewart, Program Leader, Marine Advisory Service
Dr. Victor Scottron, Director, Connecticut Sea Grant Office

University of Delaware
College of Marine Studies
Newark, Delaware
Dr. William Gaither, Dean
Mr. Richard Schneider, Executive Officer
Dorothy Woods, Academic Affairs Coordinator

University of Hartford
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Dr. Stephen J. Trachtenberg, President

University of Maine
Center for Marine Studies
Orono, Maine
Dr. Robert Bayer
Mr. Ron Dearborne, Executive Director of Sea Grant

University of Miami
Rosenstiel School of Marine and Atmospheric Sciences
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West Haven, Connecticut

University of Rhode Island
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Dr. James Griffin, Director of Technical Services
Dr. Stephen Olsen, Director of Coastal Resources Center
Dr. Robert Sexton, Assistant to the Dean, Graduate School of Oceanography

University of Rhode Island
Department of Fisheries and Marine Technology
Wickford, Rhode Island
Mr. George Gamache, Instructor

Virginia Institute of Marine Science
College of William and Mary
Gloucester Point, Virginia
Mr. Bert Brummer, Assistant Comptroller
Dr. Frank Perkins, Director of VIMS and Dean of the School of Marine Science
Mr. John Zeigler, Associate Director of VIMS

Wesleyan University
Middletown, Connecticut
Dr. Drew Carey, Assistant Professor of Earth & Environmental Sciences Department
Dr. Gregory Horne, Professor of Earth & Environmental Sciences Department

Woods Hole Oceanographic Institution
Woods Hole, Massachusetts
Nancy Green, Public Affairs
Mr. Derek Spencer, Associate Director of Research

Western Connecticut State University
Danbury, Connecticut
Dr. Mel Goldstein, Director of Weather Center

Yale University
New Haven, Connecticut
Dr. Karl K. Turekian, Professor of Geology and Geophysics

MARINE RELATED BUSINESSES, MEMBERSHIP ORGANIZATIONS, AND OTHERS

American Petroleum Institute
Washington, D.C.
Lois Sherman, Research Librarian

Analysis & Technology, Inc.
North Stonington, Connecticut
Mr. Mitch Henderson, Operations Effectiveness, Department Head

Connecticut Commercial Fishermen's Association
Fairfield, Connecticut
Mr. Chris Stapelfeldt, President

Connecticut Marine Trades Association
Essex, Connecticut
Mr. Dennis Snow, President

Connecticut State Labor Council - AFL/CIO
Hamden, Connecticut
Mr. John Driscoll, President

Crescent Communications Corporation
New London, Connecticut
Mr. Cohen, President

Dauntless Shipyard Marina, Inc.
Essex, Connecticut
Mr. Lucas, Marina Manager

Dockside Electronic Service
Noank, Connecticut
Mr. Thomas Betts, Owner

Dow Chemical Company
Gales Ferry, Connecticut
Mr. Robert Dugas, Employee Relations Manager

Electric Boat Company
Division of General Dynamics Corporation
Groton, Connecticut
Mr. John Hunter, Assistant General Manager for Special Projects
Mr. Emitt Holt, Director of Public Affairs
Mr. George Mitchell, Manager of Employment and Training

Essex Boat Works, Inc.
Essex, Connecticut
Mr. Wilson

Hydrospace Systems
New London, Connecticut
Mr. Neil MacNamara, Technical Publications

Hydrontronics, Inc.
New London, Connecticut
Linda Russell, Personnel

Legnos Boat Building Company, Inc.
Groton, Connecticut
Mr. Peter Legnos, President

Long Island Oyster Farm, Inc.
New Haven, Connecticut
Mr. Charles Johnson, Location Manager

Marine Draftsmen's Association
Groton, Connecticut
Jane Pillar, Financial Secretary

Mystech Associates, Inc.
Mystic, Connecticut
Mr. Feldman, President

Mystic Marinelife Aquarium
Mystic, Connecticut
Mr. Stephen Spottee, Vice President and General Manager

Mystic Seaport Museum
Mystic, Connecticut
Mr. William North, Public Affairs Director

Northeast Utilities
Millstone Environmental Laboratory
Millstone Point, Waterford, Connecticut
Mr. Bonde Johnson, Lab Supervisor
Mr. Joseph Vizarek, Associate Scientist

Oceanic Society, Inc.
Stamford, Connecticut
Mr. Thomas Jackson, Long Island Sound Task Force
Mr. Christopher Roosevelt, President

Pfizer Chemical Company
Central Research Division
Groton, Connecticut
Dr. Edward Wiseman, Executive Director Research

Rathburn Marine Surveying, Inc.
Noank, Connecticut
Captain Rathburn, Owner

Rockwell International
Marine Systems Division
Groton, Connecticut
Mr. Bruce Carver, Administrative Coordinator

Rockwell International Autonetics
Marine Systems Division
Groton, Connecticut
Mr. Jay Mallory, Technical Staff

Science Applications, Inc.
Newport, Rhode Island
Mr. Robert Lobecker, Senior Systems Engineer

Smith Insurance, Inc.
Niantic, Connecticut
Mr. Brian Sullivan, Agent

Sonalysts, Inc.
North Waterford, Connecticut
Kathleen McFadden, Research Analyst

Southeastern Connecticut Chamber of Commerce
New London, Connecticut
Mr. Pierce Connair, Director

Southern New England Fishermen's Association
Stonington, Connecticut
Mr. Douglas Riley, President

Spicer's Marina, Inc.
Groton, Connecticut
Mr. John Spicer, Partner & General Manager

Tallmadge Brothers
South Norwalk, Connecticut
Mr. Hilard Bloom, President

Tracor, Inc.
Groton, Connecticut
Mr. Peter Hall, Division Director

UNC Naval Products, Inc.
Montville, Connecticut
Mr. Ray Sanford, Manager Employee Relations

United Technologies Corporation
Hartford, Connecticut
Mr. Melvin Schneidermeyer, Director of Environmental Programs

Whaling City Dredge and Dock Corporation
Groton, Connecticut
Mr. Robert Sharp, President

APPENDIX 5

APPENDIX 5: BIBLIOGRAPHY

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